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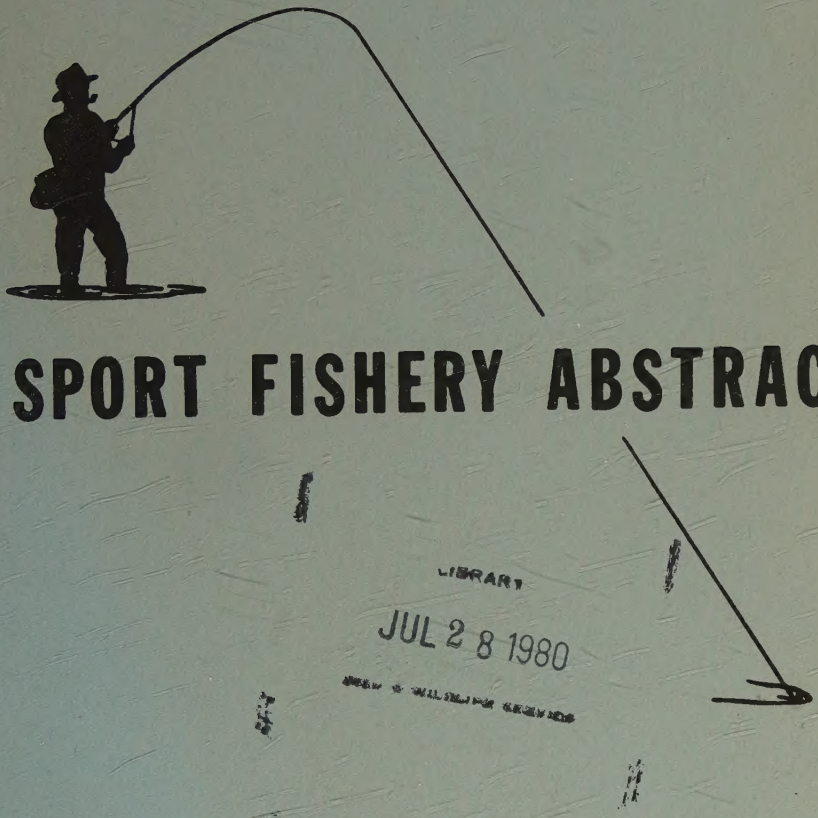

SPORT FISHERY ABSTRACTS

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DEPARTMENT OF THE INTERIOR
U. S. FISH AND WILDLIFE SERVICE

UNITED STATES DEPARTMENT OF THE INTERIOR
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SPORT FISHERY ABSTRACTS

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Sport Fishery Abstracts is intended to furnish fishery biologists with abstracts of current literature in sport fishery research and management.

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Volume 25 Number 2 1980

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PLEASE NOTE

This is the first issue of *Sport Fishery Abstracts* for which camera-ready copy has been produced in the Editorial Office. Computer techniques have not been finalized and the copy format is not exactly as we desire. We have decided, however, to publish on schedule rather than wait until every minor problem has been solved, and trust you will accept the few copy irregularities which in no way affect the scientific integrity of the contents.

The Ed.

AQUATIC PLANTS AND THEIR CONTROL

80-000782 Borawa, J. C.; A. W. Mullis; J. H. Kerby and M. T. Huish. COMPARISON OF FISH POPULATION DATA COLLECTED FROM CURRITUCK SOUND, NORTH CAROLINA, BEFORE AND AFTER INFESTATION BY EURASIAN WATERMILFOIL. *J. Elisha Mitchell Sci. Soc.* 94(2):111. 1978. Abstract only. SFA 25(2)

Fish samples obtained by applying rotenone in three areas of Currituck Sound from 1959 to 1965 inclusive, before the Sound became infested with Eurasian watermilfoil (*Myriophyllum spicatum*), were compared with samples from the same areas taken in 1977. Mean total numbers of fish per hectare of sampled area in 1959-65 were significantly lower ($p < 0.05$) than those found in 1977. Estimated total weight of fish per hectare in 1977 was not significantly different from the mean value for estimates based on pre-watermilfoil samples. Largemouth bass (*Micropterus salmoides*) were separated into young-of-the-year and older fish on the basis of length frequency distributions. Numbers of young-of-the-year largemouth bass were not significantly different ($p > 0.05$) before and after watermilfoil invasion. Numbers of older bass per hectare were significantly lower in the 1977 samples. However, differences between the areas sampled may account for this decrease rather than responses of the fish to the watermilfoil.

GENERAL FISH CULTURE

80-000783 Anonymous. PROPAGATION AND DISTRIBUTION OF FISH FROM NATIONAL FISH HATCHERIES FOR FISCAL YEAR 1976. *U.S. Fish Wildl. Serv. Fish Dist. Rep.* 11. 65p. 1979. SFA 25(2)

80-000784 Brown, E. E. THE FOOD, BAIT, TROPICAL AND GOLDFISH INDUSTRIES IN THE U.S.A. *Riv. It. Piscic. Ittiop.* 14(4):117-122. Oct.-Nov.-Dec. 1979. In English and Italian. SFA 25(2)

[Dep. Agric. Econ., Univ. Ga., Athens 30602]

80-000785 Bruley, G. K. and J. L. Horton. CALIFORNIA TROUT, SALMON, AND WARMWATER FISH PRODUCTION AND COSTS, 1978-79. *Calif. Dep. Fish Game Inland Fish. Admin. Rep.* No. 80-1. 48p. Jan. 1980. SFA 25(2)

[Calif. Dep. Fish Game, Inland Fish. Br., Sacramento]

80-000786 Garling, D. L., Jr.; L. A. Helfrich and G. D. Hutton. EDUCATIONAL FACILITIES AND PROGRAMS AT STATE AND FEDERAL FISH HATCHERIES IN THE SOUTHEASTERN UNITED STATES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:774-779. 1978[1979]. SFA 25(2)

[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061] In 1977, a 5 page questionnaire was developed and sent to hatchery managers in 11 southeastern states to characterize the status of current hatchery education programs. The survey indicated that approximately 1.4 million people visited the 55 hatcheries providing a unique opporunity to communicate directly with a large segment of the general public. A majority of the managers (98%) recognized the importance of public education and most (71%) felt that their current programs were in need of improvement. The programs relied heavily on self-guided tours, guided tours, an array of audiovisual aids, and publications. Although most managers (72%) felt they could justify increased budgetary allotments for educational program improvement, they did not expect increased funding. Integrating tours, audiovisual materials and publications into an effective program presenting an overview of the total fisheries management program will ultimately result in the greatest benefit to the

GENERAL FISH CULTURE

80-000786 CONTINUED agency and resource. In order to develop improved effective fisheries educational programs at government fish hatcheries, educational programs must be given a higher priority in terms of funding and manpower.

80-000787 Gorbunov, K. V.; A. F. Sokol'skii and N. I. Tamrazova. CORRELATIONS BETWEEN PHYTOPLANKTON AND BACTERIOPLANKTON PRODUCTION AND FISH PRODUCTIVITY IN FISH HATCHERY PONDS OF THE VOLGA DELTA. *Sov. J. Ecol. (Engl. Transl. Ekologiya)* 10(3):223-229. Jan. 1980. SFA 25(2)

Comparative data are presented for biomass, production, and P/B coefficients for microorganisms; also, rations are computed for bacterioplankton and fish in ponds of various categories. It has been established that in spawning-rearing ponds, 2/3 of overall metabolism of the heterotrophic population is made possible by energy contained in allochthonous organic matter. In ponds used for rearing sturgeons and for fattening and rearing carp, the role of allochthonous organic matter was insignificant. The productivity of these ponds is determined by the level of phytoplankton development and the magnitude of primary production. The role of fishes is also considered in the flow of energy in the ecosystems of pools and ponds, as well as other questions.

80-000788 Jhingran, V. G. RECENT ADVANCES IN INLAND AQUACULTURE IN INDIA. *J. Bombay Nat. Hist. Soc.* 75(3):589-599. Dec. 1978. SFA 25(2)

[Cent. Inland Fish. Res. Inst., Barrackpore, India]

80-000789 Leith, D. A., (Chairman). PROCEEDINGS OF THE TWENTY-NINTH ANNUAL NORTHWEST FISH CULTURE CONFERENCE. *Proc. Annu. Northwest Fish Cult. Conf.* 29:v + 114p. 1979. SFA 25(2)

A collection of papers.--RS

80-000790 Orth, D. J. APPLICATIONS OF OPERATIONS RESEARCH AND SYSTEMS SCIENCE IN AQUACULTURE. *Fisheries (Bull. Am. Fish. Soc.)* 5(1):7-9. Jan.-Feb. 1980. SFA 25(2)

[Okla. Coop. Fish. Res. Unit, Okla. State Univ., Stillwater]

80-000791 Sarig, S. FISHERIES AND FISH CULTURE IN ISRAEL IN 1978. *Bamidgeh* 31(4):83-95. Dec. 1979. SFA 25(2)

[Lab. Res. Fish Dis., Nir-David, Israel]

80-000792 Scanlon, P. F.; L. A. Helfrich and R. E. Stultz. EXTENT AND SEVERITY OF AVIAN PREDATION AT FEDERAL FISH HATCHERIES IN THE UNITED STATES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:470-473. 1978[1979]. SFA 25(2)

[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061] A survey of Federal fish hatcheries in the United States was conducted to determine the extent and severity of avian predation on fish stocks as well as to determine which avian species were the most serious predators. A list of 58 birds species in 14 families was provided. Managers of hatcheries were asked to indicate which species or members of what family caused problems by predation in their hatcheries. They were asked to provide their estimate of the severity of the problem; i.e. severe, significant, trivial, or none. They were also asked which fish species were preyed upon and also to identify any bird predators not on the list provided. The survey elicited a 66% response from 121 managers. Of the 58 species on the survey form, 28 species in 9 families were

GENERAL FISH CULTURE

80-000792 CONTINUED mentioned by managers as predators visiting fish hatcheries. Additionally, 8 species from 6 other families or subfamilies were added by managers as being pests at hatcheries. Eighteen species in 8 families were mentioned as causing "severe" damage to fish stocks.

TROUT AND SALMON CULTURE

80-000793 Bams, R. A. EVALUATION OF GRAVEL INCUBATORS ON THE THIRD CYCLE OF TSOLUM RIVER PINK SALMON, 1972-74. *Fish. Environ. Can. Fish. Mar. Serv. Tech. Rep.* No. 871. iv + 31p. Mar. 1979. In English with French summ. SFA 25(2)

[Fish. Mar. Serv., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] A new incubation method was designed for Pacific salmon that migrate to sea as fry, involving deep-gravel incubators. The method required evaluation to establish efficiency of incubation and survival potential of the fry. This report covers the third consecutive test carried out from 1972 to 1974 on the even-year pink salmon population of the Tsolum River, B.C., Canada. About one fifth of the available eggs were taken into the hatchery, the remainder was deposited naturally in the stream. Comparison with the natural population at the fry stage showed that the hatchery treatment was conducive to superior survival (93 versus 21 percent) and equal yolk-conversion efficiency. It did induce the fry to emerge at an average stage of development about 11 days earlier than that of the creek fry, at the prevailing water temperatures. Evaluation at the adult stage was made possible by the release of differentially fin-clipped fry populations of the two incubation treatments. No difference in survival was observed at two sampling locations, the commercial fishery and the main river below the hatchery weir. However, among the marked fish entering the weir the proportion of hatchery fish was significantly less than expected on the basis of numbers of marked fry released. It is concluded that, even though the hatchery treatment resulted in four times as many adults per unit of eggs, fry to adult survival was suppressed by about 6-8 percent in the hatchery fish. This difference in ocean survival may be associated with a delayed mortality of inferior stock, "artificially" kept alive in the hatchery.--From abstr.

80-000794 Busack, C. A. and G. A. E. Gall. ANCESTRY OF ARTIFICIALLY PROPAGATED CALIFORNIA RAINBOW TROUT STRAINS. *Calif. Fish Game* 66(1):17-24. Jan. 1980. SFA 25(2)

[Dep. Anim. Sci., Univ. Calif., Davis 95616] A historical treatment of the ancestry of the nine strains of rainbow trout artificially propagated by the California Department of Fish and Game is presented: Pit River, Eagle Lake, Junction Kamloops, Davis, Mt. Shasta, Virginia, Hot Creek, Mt. Whitney, and Coleman. The first three strains listed are descendants of collections from single populations; the other six are the result of mixing or deliberately crossing strains.

80-000795 Fagerlund, U. H. M. and H. M. Dye. DEPLETION OF RADIOACTIVITY FROM YEARLING COHO SALMON (*ONCORHYNCHUS KISUTCH*) AFTER EXTENDED INGESTION OF ANABOLICALLY EFFECTIVE DOSES OF 17α-METHYLTESTOSTERONE-1,2-^{3}H. *Aquaculture* 18(4):303-315. Dec. 1979. SFA 25(2)

[Dep. Fish. Oceans, 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada] Radioactivity in blood and 16 tissues of yearling coho salmon (*Oncorhynchus kisutch*) was followed during 3 days of feeding a diet supplemented with 1 mg/kg 17α-methyltestosterone-1,2-^{3}H (MT) and during 10 days following the withdrawal of the hormone from the diet. Maximum uptake in

TROUT AND SALMON CULTURE

80-000795 CONTINUED blood and non-excretory tissues was apparently reached within 2 h of the first isotope intake. High concentrations of radioactivity in the intact gall bladder 2, 8 and 16 h after a previous isotope intake indicated a hepatobiliary route of elimination. The combined concentrations of MT and its metabolites in blood and tissues, calculated as MT equivalents from residual radioactivity, were generally higher than those previously reported for testosterone, which may explain the greater anabolic effect of MT. After 10 days of feeding the hormone-free diet, the concentration of radioactive substances was reduced to less than 1 ng/g (=ppb) in all tissues. The highest concentration at that time 0.98 ng/g, appeared in the liver.

80-000796 Jarrams, P. EGG, FRY AND SMOLT PRODUCTION FROM SALMON, *SALMO SALAR* L. AND SEA TROUT *SALMO TRUTTA* L. REARED ENTIRELY IN FRESH WATER. *J. Fish Biol.* 15(5):607-611. Nov. 1979. SFA 25(2)
[Severn Trent Water Auth., Area Fish. Off., Meadow Lane, Nottingham, England]

80-000797 Jensen, J. W. WINTER CULTURE OF RAINBOW TROUT (*SALMO GAIRDNERI*) IN EARTHEN PONDS AT AUBURN, ALABAMA. *Ph.D. dissertation, Auburn Univ.* 69p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(8):3504. Feb. 1980. SFA 25(2)
Rainbow trout were cultured successfully in standing-water earthen ponds at Auburn, Alabama, during winter. In open-water culture, fish fed according to a feeding chart increased in weight as stocking density increased. Maximum standing crop attained was 1,990 kg/hectare. A satiation feeding study gave inconclusive results as to amounts of food fish would consume voluntarily at different water temperatures. Rainbow trout in 0.45 m^3 cages in a watershed pond produced 67.6 kg/m^3 of cage volume. Net production increased as stocking density increased in cages. Fish in earthen ponds fed according to a feeding chart converted food at an average rate of 1 kg fish per 1.2 kg food both years (conversion value = 1.2). Cage-reared trout converted food less efficiently (conversion value = 1.6). Survival for all experiments was about 90%. Use of rainbow trout in a double-crop aquacultural system with channel catfish will lead to greater profits than catfish alone. In a 1-hectare pond, net income from trout would amount to $1,139. Catfish alone would provide $972 in net returns.

80-000798 Light, J. T.; C. A. Sikora and J. T. Windell. HATCHABILITY OF EYED AND GREEN RAINBOW TROUT (*SALMO GAIRDNERI*) EGGS IN FIELD AND LABORATORY PLACED WHITLOCK/VIBERT BOXES. *J. Colo-Wyo. Acad. Sci.* 12(1):15. Apr. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. Colo., Boulder] A combined laboratory and field study was conducted to investigate the hatchability of rainbow trout (*Salmo gairdneri*) eggs in Whitlock/Vibert boxes. Part I of the study was conducted in the spring and part II in the fall. Part I included 25,000 green eggs of the Arlee strain of rainbow trout placed in Whitlock/Vibert boxes (both black and white) in Boulder Creek and in a controlled laboratory stream. The artificial stream was kept at constant temperature close to that of the natural stream environment. The boxes were observed periodically to determine when all eggs had hatched and fry had evacuated the boxes. It was assumed the stream-placed eggs had completed development at the same time as those in the laboratory. Once recovered, the remaining undeveloped eggs were counted and percent hatchability calculated for the total number of eggs in each box (554) at each location. Hatchability of green eggs (part I - spring) was greater in Boulder Creek (36.5%) than in the laboratory (12%). Hatchability

TROUT AND SALMON CULTURE

80-000798 CONTINUED of eyed eggs (part II - fall) in Boulder Creek was 85.7% whereas only 40.5% hatched in the laboratory. Therefore, it is recommended that eyed eggs be used by fisheries managers to achieve high hatchability in Whitlock/Vibert boxes.

80-000799 Macquarrie, D. W.; W. E. Vanstone and J. R. Markert. PHOTOPERIOD INDUCED OFF-SEASON SPAWNING OF PINK SALMON (*ONCORHYNCHUS GORBUSCHA*). *Aquaculture* 18(4):289-302. Dec. 1979. SFA 25(2)

[Dep. Fish. Oceans, 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada] Four groups of pink salmon, which had been reared under artificial light, became sexually mature and produced viable gametes: 59 days prior to, and 19-32 days, 115 days and 220 days after their expected date of reaching sexual maturity. Altered times of sexual maturation were obtained by accelerating, leaving unchanged, or decelerating the rate of change of photoperiod which each group of fish would normally receive during its first year of life. All groups of fish were exposed to a normal rate of change in photoperiod during their final year of life. Mean fecundity was reduced from 800-2000 ova observed in wild stocks, and ranged from 629 for the 59 day advanced fish, to 862 for the 115 day delayed fish. Egg mortality during the period from fertilization to eyeing was much greater in the three groups of fish subjected to accelerated or decelerated rates of change in photoperiod than in the fish subjected to the normal rate of change in photoperiod. Some of the progeny of the 220 day delayed fish, which were reared under artificial light with the normal rate of change in photoperiod set 220 days out-of-phase, became sexually mature 2 years after they had begun life as fertilized eggs.

80-000800 Ryman, N. and G. Ståhl. GENETIC CHANGES IN HATCHERY STOCKS OF BROWN TROUT (*SALMO TRUTTA*). *Can. J. Fish. Aquatic Sci.* 37(1):82-87. Jan. 1980. In English with French summ. SFA 25(2)

[Dep. Genet., Univ. Stockholm, Box 6801, S-113 86 Stockholm, Sweden]

80-000801 Sikora, C. A. A BACTERIOLOGICAL STUDY OF ORGANISMS AFFECTING THE HATCHABILITY OF RAINBOW TROUT (*SALMO GAIRDNERI*) EGGS IN WHITLOCK-VIBERT BOXES. *J. Colo.-Wyo. Acad. Sci.* 12(1):15. Apr. 1980. Abstract only. SFA 25(2)

[Dep. Biol., Univ. Colo., Boulder] Recently there has been pressure on state agencies by various fishing groups to implement the use of Whitlock/Vibert boxes in Colorado streams to facilitate a more natural trout population. To study one of the drawbacks of this method, eyed eggs from fall spawning Arlee strain rainbow trout (*Salmo gairdneri*) were obtained from the Fort Collins hatchery in October 1979 and placed in W/V boxes. Thirty-eight boxes were loaded with 554 eggs each at the hatchery and transported to upper Boulder Creek where 27 were buried in a gravel riffle. The other 11 boxes which served as controls were placed in a laboratory stream. Water samples from the hatchery, the laboratory stream, and Boulder Creek were analyzed for specific bacterial content. The total number of organisms per milliliter of water at each site was determined. Following the egg incubation period a bacterial count was conducted on the dead eggs. A comparison was made between the bacterial count from the eggs and the total number of eggs hatched to determine the relationship between the number of bacteria present and the hatchability of the eggs in the W/V boxes. There was a linear relationship between the bacterial content and the percent egg hatchability.

WARMWATER CULTURE

80-000802 Anonymous. PROGRESS REPORT OF THE FRESHWATER AQUACULTURE CENTER. *Prog. Rep. Freshwater Aquacult. Cent. Cent. Luzon State Univ.* No. 14. v + 62p. 1979. SFA 25(2)
[Freshwater Aquacult. Cent., Cent. Luzon State Univ., Muñoz, Nueva Ecija 2320, Philippines]

80-000803 Beyerle, G. B. EXTENSIVE CULTURE OF WALLEYE FRY IN PONDS AT THE WOLF LAKE HATCHERY, 1975-1978. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1874. 28p. 26 Dec. 1979. SFA 25(2)
[Mich. Dep. Nat. Resour., East Lansing] Over a 4-year period extensive culture techniques were refined so that walleye fry stocked at the rate of 3.5 per cubic meter in naturally fertile ponds at Wolf Lake Hatchery could be raised in 6 to 7 weeks to a mean length of 50 mm with a survival of 90% or more. The principal food item for the walleyes during the entire rearing cycle, *Daphnia pulex*, was maintained best by weekly applications of horse or sheep manure (32 ppm) and torula or brewer's yeast (5.3 ppm). A recommended step-by-step procedure is presented.

80-000804 Cook, A. F. and R. E. Peter. THE EFFECT OF TEMPERATURE ON THE CLEARANCE OF INTRAPERITONEALLY-INJECTED GONADOTROPIN IN THE GOLDFISH *CARASSIUS AURATUS*. *Aquaculture* 19(3):275-285. Mar. 1980. SFA 25(2)
[Zool. Dep., Univ. Alberta, Edmonton, AB T6G 2E9, Canada] The serum half-disapperance time ($t_{\frac{1}{2}}$), metabolic clearance rate and volume of distribution of intraperitonenally administered carp gonadotropin (cGtH) and endogenous GtH levels were determined in sexually mature male and female goldfish, *Carassius auratus* maintained at 12 ± 1°C or 20 ± 1°C. The results indicated that the rate of serum uptake of the injected cGtH from the peritoneal cavity was greater at 20°C than at 12°C in sexually mature male goldfish. Although increased endogenous serum GtH levels and decreased values of serum $t_{\frac{1}{2}}$ were associated with the elevated temperature, there was no difference in any of the parameters between sexually mature male and female goldfish acclimated to 12°C.

80-000805 Flüchter, J. REVIEW OF THE PRESENT KNOWLEDGE OF REARING WHITEFISH (COREGONIDAE) LARVAE. *Aquaculture* 19(2):191-208. Feb. 1980. SFA 25(2)
[Bayer. Landesanst. Fisch., 8130 Starnberg, Weilheimer Str. 8a, West Germany] Intensive fishing of whitefish (*Coregonus lavaretus*) and a survival rate of early stages of the fry that is generally too low lead, at present, to the whitefish stocks not being able to utilize fully the natural food resources now produced many times in excess of the requirements by the eutrophication of lakes. Feeding experiments in aquaria have, for several years, shown very impressively, that there are two main reasons for the high mortality of the larvae in the natural environment:high sensitivity to even a short-term lack of food and specific food requirements--the necessity for the larvae to feed on the juvenile stages of certain zooplanktonic crustaceans. Artificial breeding of whitefish eggs in cold water at 1°C caused a delay in hatching of about 8 weeks compared with natural hatching, thus allowing the release of the larvae at a time when the density of zooplankton is about ten times higher and mainly juvenile stages of crustaceans needed by the whitefish larvae are present. Hence this is one proven way of improving the survival rate of whitefish larvae in the natural environment. Young fish, after metamorphosis, have less specialized food requirements than the larval stage and can even be fed adequately with dry food. In rearing the larvae, natural zooplankton can be replaced by the nauplii of the brine shrimp, *Artemia salina*. Larvae have not yet been reared on dry food or even on slowly frozen zooplankton or *Artemia*, but

WARMWATER CULTURE

80-000805 CONTINUED *Artemia* nauplii shock-frozen in liquid nitrogen (at -196°C) were found to be as acceptable as living ones and allowed metamorphosis of the larvae to take place. The substance, assumed to be present in the living *Artemia*, which was lost on slow-freezing but retained after shock-freezing and was shown to be essential to the whitefish larvae, was insoluble in water. Biochemical investigation and identification of this substance are urgently required in order to synthesize an artificial complete food for whitefish larvae. As long as this artificial food is not available, attention will have to be focussed on rearing the larvae in natural ponds where the specific and essential zooplankton can be encouraged.

80-000806 Fry, D. L. and J. A. Osborne. ZOOPLANKTON ABUNDANCE AND DIVERSITY IN CENTRAL FLORIDA GRASS CARP PONDS. *Hydrobiologia* 68(2):145-155. 31 Jan. 1980. SFA 25(2)
[Dep. Biol. Sci., Univ. Cent. Fla., Orlando 32816] The effect of the Asian grass carp (*Ctenopharyngodon idella* Val.) upon the zooplankton in three adjacent experimental ponds (0.139 ha each) was studied for one year. The ponds contained nine species of aquatic macrophytes. Grass carp were stocked into Pond I (65 per ha) and Pond 2 (611 per ha) three months after the study was started. At the time of stocking, physicochemical and biological parameters were similar among the ponds. Grass carp did not affect water quality and had little direct or indirect effect upon the zooplankton in the ponds. The abundance and species diversity of zooplankton (number of species, Shannon Index, and Simpson Index) were not significantly different ($P < 0.05$) between ponds prior to grass carp stocking. After stocking with grass carp, the number of species and species diversity were found to be significantly different ($P < 0.05$) between Pond I (low grass carp stocking rate) and Pond 2 (high grass carp stocking rate). Additionally, significant differences ($P < 0.05$) in populations between ponds were found for *Lecane luna*, *Monostyla bulla*, *Lepadella ehrenbergii*, *Polyarthra* sp., and *Synchaeta* sp. Temporal variation rather than grass carp was probably responsible for those differences. The number of zooplankton per group (Rotifera, Cladocera, and Copepoda) and species diversity were not significantly different ($P < 0.05$) between ponds containing different stocking rates of grass carp. During the study, zooplankton were collected with a shallow-water sampler. No significant differences ($P < 0.05$) between collections were found for the sampler and a No. 20 mesh nylon zooplankton net.

80-000807 Halevi, A. OBSERVATIONS ON POLYCULTURE OF FISH UNDER STANDARD FARM POND CONDITIONS AT THE FISH AND AQUACULTURE RESEARCH STATION, DOR, DURING THE YEARS 1972-1977. *Bamidgeh* 31(4):96-104. Dec. 1979. SFA 25(2)
[Fish Aquacult. Res. Stn., Dor, Israel]

80-000808 Hearn, M. THE POND-SPAWNING AND FINGERLING PRODUCTION OF MUSKELLUNGE AT THE MINOR E. CLARK FISH HATCHERY, KENTUCKY, DURING 1973. *Ky. Dep. Fish Wildl. Resour. Fish. Bull.* no. 61. 43p. 1974. SFA 25(2)
[Clark Fish Hatchery, Rt. 4, Morehead, KY 40351]

80-000809 Kulkarni, C. V. and S. N. Ogale. THE PRESENT STATUS OF MAHSEER (FISH) AND ARTIFICIAL PROPAGATION OF *TOR KHUDREE* (SYKES). *J. Bombay Nat. Hist. Soc.* 75(3):651-660. Dec. 1978. SFA 25(2)
[B/4, Shardashram, B. Shankar Rd., Bombay 400 028, India]

WARMWATER CULTURE

80-000810 von Lukowicz, M. and C. Proske. PRODUCTION AND REPRODUCTION OF TENCH. *Riv. It. Piscic. Ittiop.* 14(4):109-112, 115-116. Oct.-Nov.-Dec. 1979. In English and Italian SFA 25(2)
Bayerische Landesanst. Fisch., 8130 Starnberg, Weilheimer Str. 8a, West Germany]

80-000811 Zur, O. THE APPEARANCE OF CHIRONOMID LARVAE IN PONDS CONTAINING COMMON CARP *(CYPRINUS CARPIO). Bamidgeh* 31(4):105-113. Dec. 1979. SFA 25(2)
[Fish Cult. Exp. Stn., Ginosar, P.O. Box 33, Tiberias, Israel] In fish ponds, the predation tension of the Common Carp on chironomid larvae is high. At fish concentrations of 500, 1,000, 4,000 and 10,000 fish/ha, reduction in larval concentration was 83.93, 93.9, 93.69 and 99.82%, respectively. The fish did not exhibit any preferential predation according to size of prey. There was no correlation between the appearance of the larvae and the height of the pond's water column (within the range of 37-90 cm). During the growth season, no fluctuations in rate of egg deposition were observed. The larvae appeared at the bottom of the pond at the rate of 1953 larvae/m^2/day. If the minimal edible size is 0.09 mg, this means daily consumption of 1.75kg/ha. It seems that in commercial fish ponds, chironomid larvae may serve either as growth limiting or growth promoting factors.

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80-000812 Ranoemihardjo, B. S. and A. M. Pirzan. EFFECT OF STOCKING DENSITY ON THE RATE OF GROWTH OF MILKFISH FRY *(CHANOS CHANOS). Bull. Brackishwater Aquacult. Dev. Cent. (Jepara)* 3(1-2):247-257. Jan.-July 1977. SFA 25(2)
[Brackishwater Aquacult. Dev. Cent., Jepara, Indonesia] Survival rate of milkfish fry in nursery pond is usually about 20-40%. With intensive preparation, the survival could be increased to about 60-80%. Culture of fry in small compartment is much easier to control and mortality could be reduced. More intensive care and management in the nursery pond makes the fry more healthy, results in higher survival and makes transfer easier to the rearing pond. The result of the experiment in the wooden box as nursery had shown that the fry grew from 14.62 mm in total length and 7.88 mg in weight to an average of 29.49 mm in total length and 180.85 mg in weight or an increment of 14.87 mm and 172.97 mg, respectively, after four weeks rearing. Stocking density ranged from 35 to 95 fry per square meter with an average survival rate of 97 percent.--From abstr.

80-000813 Scholes, P. THE SEA-WATER WELL SYSTEM AT THE FISHERIES LABORATORY, LOWESTOFT AND THE METHODS IN USE FOR KEEPING MARINE FISH. *J. Mar. Biol. Assoc. UK* 60(1):215-225. Feb. 1980. SFA 25(2)
[Minist. Agric. Fish. Food, Fish. Lab., Lowestoft, Suffolk, England]

80-000814 Tatum, W. M.; W. C. Trimble and R. F. Helton, Jr. PRODUCTION OF GULF KILLIFISH IN BRACKISH-WATER PONDS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:502-508. 1978[1979]. SFA 25(2) Claude Peteet Maricult. Cent., Ala. Dep. Conserv. Nat. Resour., Gulf Shores 36542] Production of gulf killifish (*Fundulus grandis*) was investigated from 17 November 1977 to 10 July 1978 in 0.08 ha, brackish-water, earthen ponds at the Claude Peteet Mariculture Center. Gulf killifish averaging 30.7 g and stocked at 12,500 fish/ha deposited eggs on Spanish moss spawning mats from 21 March through 16 May 1978. Fifty mats with eggs were transferred to a hatching pond which yielded 82,500 juvenile killifish averaging 0.1 g at harvest on 16 May. Stocked at 250,000 fish/ha in 3 grow-out ponds on 19 May and fed a commercial minnow feed, the juveniles averaged 2.0 g (marketable

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80-000814 CONTINUED size) on 10 July 1978 with mean survival of 82%, feed conversion of 1.9, and production of 427 kg/ha.

FEEDS, FEEDING, AND NUTRITION

80-000815 Abel, H.; A. Pieper and E. Pfeffer. UNTERSUCHUNGEN AN WACHSENDEN REGENBOGENFORELLEN (SALMO GAIRDNERI, R.) ÜBER DIE INTERMEDIÄRE ANPASSUNG AN PROTEIN ODER KOHLENHYDRATE ALS ENERGIETRÄGER IM FUTTER. [STUDIES ABOUT METABOLIC ADAPTATIONS OF RAINBOW TROUT (SALMO GAIRDNERI, R.) TO PROTEIN OR CARBOHYDRATES AS SOURCES OF DIETARY ENERGY. *J. Anim. Physiol. Anim. Nutr.* 41(6):325-334. May 1979. In German with English summ. SFA 25(2)
[Inst. Tierphysiol. Tierernährung, Univ. Göttingen, West Germany]

80-000816 Atack, T. H.; K. Jauncey and A. J. Matty. THE UTILIZATION OF SOME SINGLE CELL PROTEINS BY FINGERLING MIRROR CARP *(CYPRINUS CARPIO). Aquaculture* 18(4):337-348. Dec. 1979. SFA 25(2)
[Fish Farm Development International, Stronachullin, Ardrishaig, Argyll, Scotland] An experiment was conducted to determine the utilization by mirror carp of yeast (PY), bacterial (MB), algal (SA), soybean (SY), casein (CS), and herring (HM) meal proteins as the sole protein sources in semi-purified rations. A low casein (CS LOW) diet was included in the trial so that true digestibility, Net Protein Utilization (NPU) and Biological Values (BV) could be determined. All the feeds contained 30% protein other than the fishmeal and bacterial diets which contained 25 and 35%, respectively. Specific growth rates (%/day) found were MB 2.78 >CS 2.4, HM 2.26 > PY 2.08 > SY 1.24, SA 1.18 and CS LOW 1.13. Food conversion was optimal with diet MB (1.14) followed by CS (1.39), HM (1.42), PY (1.55) < SA (2.50) < SY (2.86) and CS LOW (3.04). Protein efficiency ratio was highest with the low casein diet at 3.24 decreasing in the order HM 2.82, CS 2.48 > PY 2.08 > SY 1.35 and SA 1.15. All the test proteins were well digested, assimilation values ranging from 80.3% (HM diet) to 96.6% (PY diet). The NPU's and BV's calculated from body analysis data were respectively for each protein, HM 64 and 79%, MB 49 and 52%, CS 49 and 52%, PY 47 and 49%, SY 42 and 51%, SA 36 and 41%. The above biological values are compared with various chemical scores based on amino acid analysis of the test proteins. All the results are discussed fully and also compared to values previously obtained with identical diets in rainbow trout experiments.

80-000817 Biette, R. M. THE EFFECT OF TEMPERATURE AND RATION ON GROWTH RATES, FOOD CONVERSION EFFICIENCIES AND THE FATE OF CARBON-14 LABELLED FOOD BY UNDER-YEARLING SOCKEYE SALMON, *ONCORHYNCHUS NERKA. Ph.D. dissertation, Simon Fraser Univ. (Canada)* 1978. From Diss. Abstr. Int. B Sci. Eng. 40(9):4078. Mar. 1980. SFA 25(2)
It is concluded that young sockeye ingesting moderate rations comparable to those probably available in the relatively warm surface layers of Babine Lake, and living under a thermal regime which involves twice daily migrations from deep cold waters to the surface and return, are likely to grow more rapidly and efficiently than fish maintained at constant temperatures. This suggests a possible selective value for vertical migrations in thermally stratified waters.--From abstr.

80-000818 Dahlgren, B. T. THE EFFECTS OF THREE DIFFERENT DIETARY PROTEIN LEVELS ON THE FECUNDITY IN THE GUPPY, *POECILIA RETICULATA* (PETERS). *J. Fish Biol.* 16(1):83-97. Jan. 1980. SFA 25(2)

FEEDS, FEEDING, AND NUTRITION

80-000818 CONTINUED
[Dep. Anim. Ecol., Univ. Lund, Ecology Bldg., S-223 62 Lund, Sweden] Experiments were performed to investigate the influences of dietary protein on fecundity in the guppy, *Poecilia reticulata*. No significant differences in total body length and standard length were found between females given food with different protein levels. A significantly higher total body weight was found both in females fed on 47% and 31% protein compared with females given 15% protein. The frequencies of females with only intrafollicular embryos or with only ova or both embryos and ova in the ovary were not significantly different between populations given different protein amounts. There was a significantly lower frequency of females without embryos and ova but with previtellogenic oocytes in the group given highest protein (47%) compared with the group fed on 31%. Significantly higher values of ovarian length, width and gonad weight were found among females given 47% protein compared with females fed on 15% protein. The ovarian height was significantly higher only in females given the highest protein amount when compared with the group fed on 31% protein. No significant difference of ovarian volume was found between groups given different protein contents. The average gonadosomatic ratio was highest in the groups fed on 47% protein. Significant correlations were found between gonad weight and total body weight of females in each group. Ovarian volume versus total body weight as well as differences of fecundity were found either between females given 47% and 31% protein or between females fed on 47% and 15% protein. A somewhat higher number of ova per individual fish was, however, observed among females given 31% when compared with females fed on 15% protein. The ovum size remained the same between groups given different protein contents. No significant correlation was found between fecundity and ovum diameter in the groups.

80-000819 Felts, S. K. EVALUATION OF SUPPLEMENTAL DIETS FOR GOLDEN SHINERS SHINERS. *Ph.D. dissertation, Auburn Univ.* 68p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(5):1971. Nov. 1979. SFA 25(2)
Golden shiners averaging 0.18 g/fish were stocked into twelve 0.04-hectare (0.1-acre) earthen ponds at the rate of 240,000 fish/ha (97,000 fish/a). The fish were managed for an 86-day period according to the following treatments: 1) no feed but the ponds were fertilized (45 cm maximum Secchi visibility); 2) fed an all-plant meal diet; 3) fed a meal diet containing 10 percent fish meal; and 4) fed a meal diet containing 20 percent fish meal. The shiners that were not fed weighed 465.4 kg/ha at harvest, while the fed shiners weighed 687.1, 713.5, and 744.9 kg/ha for the all-plant, 10 percent fish meal diet, and 20 percent fish meal diets, respectively. Although additions of fish meal made slight improvements in growth, there was no significant difference ($P < .05$) in weight gain among the fed treatments. Feed conversion ratios were 1.6 to 1.7 and 91 to 100 percent of the fish were larger than 5 cm in length. Digestive tract analyses revealed that the major food of the nonfed shiners was phytoplankton. An economic evaluation of returns above feed, fertilizer, and labor costs showed $1202/ha for the nonfed fish and $1564/ha to $1647/ha for the fed fish. Golden shiners fed the 10 percent fish meal diet in flowing-water aquariums (100 fish/38-liter aquarium) concurrently with those fed the same diet in ponds only gained 14.7 as much weight as the fish in the ponds. This is due to the absence of natural pond organisms and the loss of water soluble nutrients from a meal diet before they can be consumed by the fish.--From abstr.

80-000820 Freed, P. L. EVALUATION OF THE COEFFICIENT OF DIGESTIBILITY OF HERRING MENHADEN, TUNA, ANCHOVY, AND SOYBEAN MEALS BY RAINBOW TROUT (*SALMO GAIRDNERI*). *J. Colo.-Wyo. Acad. Sci.* 12(1):17. Apr. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. Colo., Boulder] The purpose of this study was to compare the coefficient of digestibility of four different meals, and diets

FEEDS, FEEDING, AND NUTRITION

80-000820 CONTINUED containing isonitrogenous levels of the meals to the Federal PR 11 control diet containing herring meal. Digestibility coefficients were computed for the major nutrients in the diets (protein and fat). Replicate groups of yearling rainbow trout, *Salmo gairdneri*, were fed the meals, the experimental diets, and the control diet after they were ground, mixed with chromic oxide marker, and repelleted. The meals, experimental diets, control diet, and feces were proximately analyzed according to standard methods. Fecal samples were collected by the anal suction method to eliminate leaching of nutrients into the water. All data were analyzed with the appropriate statistical tests. Proximate analysis of the meals indicated that organic matter content ranged from 69.5% for tuna meal to 85.7% for soya meal. Capelin, herring, anchovy, and menhaden meals were 83, 74, 77, and 76% organic matter, respectively. Fat contents ranged from 2.5% for soya to 11.5% for capelin meal. Anchovy, herring, menhanden and tuna had 9.5, 8.0, 9.3, and 5.5% fat content, respectively. Protein content ranged from a high of 72% for capelin meal to a low of 41% for soya meal.

80-000821 Gulley, D. D. EFFECT OF MINERAL ASH CONTENT ON ATLANTIC MENHADEN MEAL (*BREVOORTIA TYRANNUS*) DIGESTIBILITY BY RAINBOW TROUT (*SALMO GAIRDNERI*). *J. Colo.-Wyo. Acad. Sci.* 12(1):17. Apr. 1980. Abstract only. SFA 25(2)

[Dep. Biol., Univ. Colo., Boulder] The purpose of this study was to determine the coefficient of digestibility of commercial Menhaden meal containing either 18.8%, 21.5%, 23.8% or 26.3% levels of mineral ash. The control (18.8%) and experimental rations were mixed with the inert marker chromic oxide, pelleted into 1/8" pellets, and fed to yearling rainbow trout (Arlee strain) held in 10 C water. Percent protein nitrogen was estimated by the micro-Kjeldahl method, total lipids by reflux distillation with petroleum ether. Chromic oxide was measured by the wet acid digestion method of Furukawa and Tsukahara. The coefficient of digestibility for dry matter decreased as the ash content increased from 18.8% to 26.3%. Protein and fat digestibilities also decreased as ash content increased.

80-000822 Kaushik, S. J. and P. Luquet. INFLUENCE OF BACTERIAL PROTEIN INCORPORATION AND OF SULPHUR AMINO ACID SUPPLEMENTATION TO SUCH DIETS ON GROWTH OF RAINBOW TROUT, *SALMO GAIRDNERII* RICHARDSON. *Aquaculture* 19(2):163-175. Feb. 1980. SFA 25(2)

[Lab. Nutr. Poissons, I.N.R.A., Cent. Rech. Hydrobiol., B.P3, Saint Pée-sur-Nivelle, 64310 Ascain, France]

80-000823 Kitajima, C.; M. Yoshida and T. Watanabe. [DIETARY VALUE FOR AYU *PLECOGLOSSUS ALTIVELIS* OF ROTIFER *BRACHIONUS PLICATILIS* CULTURED WITH BAKER'S YEAST *SACCHAROMYCES CEREVISIAE* SUPPLEMENTED WITH CUTTLEFISH LIVER OIL.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):47-50. Jan. 1980. In Japanese with English summ. SFA 25(2)

[Aquacult. Res. Lab., Nagasaki Pref. Inst. Fish., Nomozaki, Nagasaki 851-05, Japan]

80-000824 Kitajima, C.; T. Arakawa, F. Oowa; S. Fujita; O. Imada; T. Watanabe and Y. Yone. [DIETARY VALUE FOR RED SEA BREAM LARVAE OF ROTIFER *BRACHIONUS PLICATILIS* CULTURED WITH A NEW TYPE OF YEAST.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):43-46. Jan. 1980. In Japanese with English summ. SFA 25(2)

[Aquacult. Res. Lab., Nagasaki Pref. Inst. Fish., Nomozaki, Nagasaki 851-05, Japan]

FEEDS, FEEDING, AND NUTRITION

80-000825 Mahajan, C. L. and N. K. Agrawal. THE ROLE OF VITAMIN C IN CALCIUM UPTAKE BY FISH. *Aquaculture* 19(3):287-294. Mar. 1980. SFA 25(2)
[Fish Biol. Lab., Dep. Zool., Univ. Rajasthan, Jaipur-3 02004, India] Calcium uptake in experimentally induced scorbutic snake heads, *Channa (=Ophicephalus) punctatus*, fed vitamin C-deficient diet for 210 days is reported, using ^{45}Ca as tracer. When compared with a parallel control on completely synthetic diet, the results show decreased absorption and utilization of calcium by gill, skin, muscle and bone of scorbutic fish from surrounding water. The physiological significance of these results is discussed, and its practical utility in aquaculture is indicated.

80-000826 Mahajan, C. L. and N. K. Agrawal. VITAMIN C DEFICIENCY IN *CHANNA PUNCTATUS* BLOCH. *J. Fish BIol.* 15(5):613-622. Nov. 1979. SFA 25(2)
[Fish BIol. Lab., Dep. Zool., Univ. Rajasthan, Jaipur-302004, India] The results of a series of experiments on *Channa punctatus* previously conditioned to a complete synthetic diet and later fed vitamin C deficient diet for 2lo days followed by 30 days of recovery with fortified vitamin C ration are reported. The survival, growth, morphological abnormalities and biochemical changes in tissue ascorbic acid and cholesterol levels were studied. Deficiency of vitamin C resulted in a mortality of up to 25% and retarded growth accompanied by anorexia and loss of weight. Marked skeletal abnormalities, *viz.*, lordosis, scoliosis and degenerative changes in the thoracic vertebrae were revealed by X-ray studies. BIochemical investigations showed a significant decrease in blood and kidney ascorbic acid levels within a month of feeding the deficient diet. A prolonged deficiency beyond 150 days resulted in a rapid rise in the cholesterol content of the liver. These biochemical changes were reversed when vitamin C was added to the ration.

80-000827 Nakashima, B. S. and W. C. Leggett. NATURAL SOURCES AND REQUIREMENTS OF PHOSPHORUS FOR FISHES. *Can. J. Fish. Aquatic Sci.* 37(4):679-686. Apr. 1980. SFA 25(2)
[Biol. Dep., McGill Univ., 1205 Ave. Docteur Penfield, Montreal, PQ H3A 1B1, Canada]

80-000828 Ogino, C. and H. Nanri. [RELATIONSHIP BETWEEN THE NUTRITIVE VALUE OF DIETARY PROTEINS FOR RAINBOW TROUT AND THE ESSENTIAL AMINO ACID COMPOSITIONS.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):109-112. Jan. 1980. In Japanese with English summ. SFA 25(2)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000829 Ogino, C.; L. Takeuchi; H. Takeda and T. Watanabe. [AVAILABILITY OF DIETARY PHOSPHORUS IN CARP AND RAINBOW TROUT.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1527-1532. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000830 Ota, T.; T. Takagi; R. Odajima and T. Terao. [EFFECT OF DIETARY LIPIDS ON GROWTH AND LIPIDS OF COHO SALMON, *ONCORHYNCHUS KISUTCH*. *Bull. Fac. Fish. Hokkaido Univ.* 30(4):294-300. Nov. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Chem. Fish Oil, Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

FEEDS, FEEDING, AND NUTRITION

80-000831 Pozar, D. F. AUTOMATIC FISH FOOD DISPENSER FOR USE WITH OREGON MOIST AND DRY FOOD PELLETS. *Prog. Fish-Cult.* 42(1):45-48. Jan. 1980. SFA 25(2)
[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

80-000832 Reagan, R. E. and H. R. Robinette. FEEDING OF CHANNEL CATFISH FINGERLINGS IN MILD AND SEVERE WINTERS IN MISSISSIPPI. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:426-428. 1978[1979]. SFA 25(2)
[Dep. Wildl. Fish., Miss. State Univ., Mississippi State 39762] A feeding study with channel catfish fingerlings (*Ictalurus punctatus*) was conducted in the winters 1975-76 and 1977-78, a mild and severe winter, respectively. In both years, fish in 3 ponds were fed 3 days per week and fish in 3 ponds were fed 6 days per week. In the 1975 study, fish fed 3 and 6 days per week averaged 10% and 45% weight gain with a mean feed conversion of 2.63 and 2.90, respectively; fish fed 6 days per week had significantly ($P<.10$) greater weight gains than the fish fed 3 days per week. In 1977 fish fed 3 days per week gained an average of 24% and had a mean conversion of 1.98. Fish fed 6 times per week had an average weight gain of 29% and a mean feed conversion of 2.50. This was not significantly ($P<.10$) different than the fish fed 3 days per week.

80-000833 Reinitz, G. and F. Hitzel. FORMULATION OF PRACTICAL DIETS FOR RAINBOW TROUT BASED ON DESIRED PERFORMANCE AND BODY COMPOSITION. *Aquaculture* 19(3):243-252. Mar. 1980. SFA 25(2)
[U.S. FWS, Spearfish Fish. Cent., Rt. 1, Box 205, Spearfish, SD 57783] Rainbow trout (*Salmo gairdneri*) with an initial average weight of 1.8 g were fed eight experimental diets with 26 and 35% protein and varying amounts of lipid for 112 days. All experimental diets contained 10% fish meal (the only source of animal protein), as compared to a control diet with 35% fish meal. The energy content of the diet was the most important factor in determining growth rate. The percentage of dietary lipid was the dominant factor in determining the body composition of rainbow trout. Increased amounts of dietary lipid resulted in fish with increased amounts of whole-body fat and reduced amounts of whole-body protein and moisture. Body composition was more closely a function of nutritional history than of fish size. Protein retention and energy retention were negatively associated with the percentage of digestible protein in the diet. Mortality rates did not differ significantly among the groups tested; the general health of all fish examined was good.

80-000834 Reinitz, G. and R. Austin. EXPERIMENTAL DIETS FOR INTENSIVE CULTURE OF YELLOW PERCH. *Prog. Fish-Cult.* 42(1):29-31. Jan. 1980. SFA 25(2)
[U.S. FWS, Rt. 1, Box 205, Spearfish, SD 57783]

80-000835 Sakamoto, S.; A. Eto; M. Furuichi and Y. Yone. PURIFIED TEST DIET FOR YELLOWTAIL--I. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1179-1183. Sept. 1979. SFA 25(2)
[Fish. Res. Lab., Kyushu Univ., Tsuyazaki, Fukuoka 811-33, Japan] This study was conducted to formulate a purified test diet for yellowtail, *Seriola quinqueradiata*. Yellowtail fingerlings were fed on a purified diet or a diet of minced jack mackerel over a 60 day period. At the end of the feeding trial, anatomico-pathological and histopathological examinations of the tissues, hematological examinations, and chemical analyses of the dorsal muscle, liver, and vertebrae were performed. Significant differences were recognized between the two groups in appetite, growth rate, and other factors, and the jack mackerel group were found superior to those of the purified diet group. However, the low mortality and comparatively high feed efficiency indicate that a purified test diet for yellowtail can be established after adequate modification of the present diet.

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80-000836 Sampath, K. and T. J. Pandian. EFFECTS OF DENSITY ON FOOD UTILIZATION AND SURFACING BEHAVIOUR IN THE OBLIGATORY AIR-BREATHING FISH *CHANNA STRIATUS*. *Hydrobiologia* 68(2):113-117. 31 Jan. 1980. SFA 25(2)
[Sch. Biol. Sci., Madurai Kamaraj Univ., Madurai 625021, India] Rearing *Channa striatus* in groups of 1, 2, 4, 8 or 16 individuals/aquarium, effects of density on food utilization and surfacing behaviour were studied. Individuals in the control group consumed more but converted less efficiently. Those reared in higher densities too consumed less and converted far less efficiently, spending greater amount of energy on surfacing. At the optimum density of 4 individuals/aquarium, the fish consumed the highest ration and converted it with maximum efficiency, conserving energy by decreased surfacing activity. Growth of smaller individuals is inhibited in the presence of larger ones at all the tested densities. The inhibition is minimum at the optimum density and is maximum at the densities of 2 and 16 individuals/aquarium. Individuals reared in the maximum density produced maximum but the mean body weight of a single individual was only half of that in the optimum density. The optimum density, which yields maximum production without sacrificing mean body weight, is profitable for aquaculture.

80-000837 Takeuchi, T. and T. Watanabe. [EFFECT OF EXCESS AMOUNTS OF ESSENTIAL FATTY ACIDS ON GROWTH OF RAINBOW TROUT.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1517-1519. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000838 Takeuchi, T.; T. Watanabe and T. Nose. [REQUIREMENT FOR ESSENTIAL FATTY ACIDS OF CHUM SALMON (*ONCORHYNCHUS KETA*) IN FRESHWATER ENVIRONMENT]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1319-1323. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000839 Tomiyama, T.; J. L. Sumner; G. W. Kitson and I. R. Perry. FATTENING OF WILD SHORT-FINNED EELS, *ANGUILLA AUSTRALIS SCHMIDTII* PHILLIPS. *N.Z. Mar. Freshwater Res.* 13(3):377-378. 1979. SFA 25(2)
[Tokyo Univ. Fish., Tokyo, Japan] Short-finned wild eels fed an artificial diet containing either a low (5%) or a high (20%) oil content were found to increase their mass by an average of more than 30% after a 34-day feeding period; the lipid content of the eels' muscle was also increased from about 10% to around 20%.

80-000840 Viola, S. and U. Rappaport. THE "EXTRA-CALORIC EFFECT" OF OIL IN THE NUTRITION OF CARP. *Bamidgeh* 31(3):51-68. Sept. 1979. SFA 25(2)
[Miloubar, D. N. Ashrat, Israel]

80-000841 Watanabe, T.; F. Oowa; C. Kitajima and S. Fujita. RELATIONSHIP BETWEEN DIETARY VALUE OF BRINE SHRIMP *ARTEMIA SALINA* AND THEIR CONTENT OF ω3 HIGHLY UNSATURATED FATTY ACIDS. *Bull. Jpn. Soc. Sci. Fish.* 46(1):35-41. Jan. 1980. SFA 25(2)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato-ku, Tokyo 108, Japan]

80-000842 Yingst, W. L. III and R. R. Stickney. GROWTH OF CAGED CHANNEL CATFISH FINGERLINGS REARED ON DIETS CONTAINING VARIOUS LIPIDS. *Prog. Fish-Cult.* 42(1):24-26. Jan. 1980. SFA 25(1)

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80-000842 CONTINUED
[N. J. Dep. Transport., Bur. Environ. Anal., 1035 Parkway Ave., Trenton 08625]

80-000843 Yingst, W. L. III and R. R. Stickney. EFFECTS OF DIETARY LIPIDS ON FATTY ACID COMPOSITION OF CHANNEL CATFISH FRY. *Trans. Am. Fish. Soc.* 108(6):620-625. Nov. 1979. SFA 25(2)
[N.J. Dep. Transportation, Bur. Environ. Anal., 1035 Parkway Ave., Trenton 08624]

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT

80-000844 Baynes, S. M.; L. Emerson and A. P. Scott. CULTURE OF ALGAE FOR LARVAL FISH AND SHELLFISH REARING. PART 3. PRODUCTION OF ALGAE FOR USE IN THE REARING OF LARVAL FISH. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 53. p. 13-18. 1979. SFA 25(2)
[Fish. Lab., Lowestoft, England]

80-000845 Buynak G. L. and H. W. Mohr, Jr. COLLAPSIBLE FISH-HOLDING CAGE. *Prog. Fish-Cult.* 42(1):41-42. Jan. 1980. SFA 25(1)
[Ichthyological Assoc., Inc., R.D. 1, Berwick, PA 18603]

80-000846 Helm, M. M.; I. Laing and E. Jones. CULTURE OF ALGAE FOR LARVAL FISH AND SHELLFISH REARING. PART 1. THE DEVELOPMENT OF A 200 L. ALGAL CULTURE VESSEL AT CONWY. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 53. p. 1-7. 1979. SFA 25(2)
[Fish. Exp. Stn., Conwy, England]

80-000847 Laing, I. CULTURE OF ALGAE FOR LARVAL FISH AND SHELLFISH REARING Part II. RECOMMENDED PROCEDURES FOR THE CULTURE OF *CHAETOCEROS CALCITRANS*. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 53. p. 8-12. 1979. SFA 25(2)
[Fish. Exp. Stn., Conwy, England]

80-000848 Parker, N. C. and G. A. Jackson. EXTERNAL STANDPIPE DRAIN SYSTEM FOR FISH TANKS. *Prog. Fish-Cult.* 42(1):53-54. Jan. 1980. SFA 25(1)
[U.S. FWS, P.O. Box 936, LaCrosse, WI 54601]

GENERAL LIMNOLOGY AND OCEANOGRAPHY

80-000849 Qasim, S. Z. OCEANOGRAPHIC RESEARCH IN INDIA--PAST, PRESENT AND FUTURE. *J. Bombay Nat. Hist. Soc.* 75(3):661-667. Dec. 1978. SFA 25(2)
[Natl. Inst. Oceanogr., Dona Paula, Goa 403 004, India]

GENERAL LIMNOLOGY AND OCEANOGRAPHY

80-000850 Short, R. A. and J. V. Ward. LEAF LITTER PROCESSING IN A REGULATED ROCKY MOUNTAIN STREAM. *Can. J. Fish. Aquatic Sci.* 37(1):123-127. Jan. 1980. In English with French summ. SFA 25(2)
[Dep. Biol. Sci., North Tex. State Univ., Denton 76203]

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[Stroud Water Res. Cent., Acad. Nat. Sci. Phila., Avondale, PA 19311]

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80-000855 Ben-Yaakov, S. A PORTABLE DISSOLVED OXYGEN ANALYZER FOR THE FISH FARMING INDUSTRY. *Bamidgeh* 31(3):69-77. Sept. 1979. SFA 25(2)
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80-000864 Arthur, D. K. DIFFERENCES IN HEART SIZE BETWEEN OCEAN-CAUGHT AND LABORATORY-GROWN LARVAE OF THE NORTHERN ANCHOVY, *ENGRAULIS MORDAX* GIRARD *J. Exp. Mar. Biol. Ecol.* 43(2):99-106. 6 Mar. 1980. SFA 25(2)
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80-000870 Bugayev, V. F. USING THE STRUCTURE OF ZONES OF CONVERGED SCLERITES ON SCALES AS A CRITERION FOR THE DIFFERENTIATION OF LOCAL GROUPINGS OF THE SOCKEYE SALMON, *ONCORHYNCHUS NERKA*, OF THE KAMCHATKA RIVER BASIN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):733-743. 1978. SFA 25(2)
[KOTINRO, Petropavlovsk-Kamchatskiy, USSR] The structure of annular and supplementary rings on the scales of spawners of the sockeye, *Oncorhynchus nerka*, in the Kamchatka River basin are studied. The number of converged sclerites in the annuli varies from 0-8, 0-1 being most characteristic of spring-fed waters, 1-2 for rivers and small lakes, and 3-4 for deep lakes. The number of converged sclerites in supplementary rings varies from 0 to 4, among which two types of zones of converged sclerites can be distinguished containing in the main 0 and 2 sclerites. For the division of annuli into river (0-2 sclerites) and lake (3-8 sclerites) the structure of the zone of converged sclerites can be used as the main criterion for the differentiation of fish, the young of which had fed in deep lakes. An analysis of differences from year to year in the structure of annuli confirms this conclusion.

80-000871 Burggren, W.; J. Dunn and K. Barnard. BRANCHIAL CIRCULATION AND GILL MORPHOMETRICS IN THE STURGEON *ACIPENSER TRANSMONTANUS*, AN ANCIENT CHONDROSTEIAN FISH. *Can. J. Zool.* 57(11):2160-2170. Nov. 1979. In English with French summ. SFA 25(2)
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[U.S.T.L., 34060 Montpellier, France]

80-000873 Carmichael, G. J. SCALE NUMBER DIFFERENCES IN *CAMPOSTOMA* (RAFINESQUE) REARED AT DIFFERENT TEMPERATURES. *J. Tenn. Acad. Sci.* 55(2):54-55. Apr. 1980. Abstract only. SFA 25(2)
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80-000873 CONTINUED *Campostoma anomalum pullum*. The progeny of four parental crosses were reared at three different temperatures (13.9°C, 17.7°C, 24.3°C). The lateral line scale number in the genus *Campostoma* was found to be influenced by temperature. *Campostoma* raised at a lower mean temperature (13.9°C ± 1.5°) had significantly (P=.01) more scales (x=47.59) in the lateral line series than those of the same crosses raised at a higher mean temperature (24.3°C ± 1.5°C)(x=44.71). Based on meristic characters (including scale number) several subspecies of *Campostoma anomalum* have been recognized. One of these subspecies (*Campostoma anomalum oligolepis*) has recently been elevated to species rank (*Campostoma oligolepis*). In part this elevation in rank is based on lateral line scale number. Due to the effect of temperature on the lateral line scale number in *Campostoma*, it would seem best to refer to specimens of the genus *Campostoma* in the binomial, i.e., *Campostoma anomalum* until the questions concerning meristic basis for taxonomic designation are answered.

80-000874 Carscadden, J. E. and R. K. Misra. MULTIVARIATE ANALYSIS OF MERISTIC CHARACTERS OF CAPELIN (*MALLOTUS VILLOSUS*) IN THE NORTHWEST ATLANTIC. *Can. J. Fish. Aquatic Sci.* 37(4):725-729. Apr. 1980. SFA 25(2)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

80-000875 Clarke, A. J. and D. M. Witcomb. A STUDY OF THE HISTOLOGY AND MORPHOLOGY OF THE DIGESTIVE TRACT OF THE COMMON EEL (*ANGUILLA ANGUILLA*). *J. Fish Biol.* 16(2):159-170. Feb. 1980. SFA 25(2)
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[Dep. Zool., Univ. Coll. North Wales, Bangor, Gwynedd, Wales]

80-000879 Dorsa, W. J. and R. A. Fritzsche. CHARACTERS OF NEWLY HATCHED LARVAE OF *MORONE CHRYSOPS* [PISCES, PERCICHTHYIDAE], FROM YOCONA RIVER, MISSISSIPPI. *J. Miss. Acad. Sci.* 24:37-41. 1979. SFA 25(2)
[Dep. Biol., Univ. Miss., University 38677]

80-000880 Dutta, H. M. COMPARATIAVE ANALYSIS OF THE HYOMANDIBULA DURING RESPIRATION IN ANABANTOID TELEOST FISHES: *MACROPODUS OPERCULARIS* IN RELATION TO *CTENOPOMA ACUTIROSTRE* AND *ANABAS TESTUDINEUS*.

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[Dep. Zool., Ohio Univ., Athens 45701]

80-000882 El-Ibiary, H. M.; T. K. Hill; J. A. Joyce and J. W. Andrews. PHENOTYPIC CORRELATIONS BETWEEN COMMERCIAL CHARACTERS IN CHANNEL CATFISH. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:420-425. 1978[1979]. SFA 25(2)
[Fac. Agric., Alexandria, Egypt] Estimates of correlation from channel catfish (*Ictalurus punctatus*) sib-families reared in intensively stocked tanks showed that it is possible to predict the family influence in market body weight from body weight data taken as early as 4 weeks. Survival during the first 15 weeks was highly correlated with body weights or lengths from 4 to 12 weeks. Food conversion during the period 20 to 40 weeks was highly correlated with body weights between 16 and 56 weeks. Correlations between survival and food conversion ratio and, also, between 4 to 12 week body size traits and either 16 to 40 or 41 to 56 week survival were not significant.

80-000883 Emel'yanova, N. G. ULTRASTRUCTURE OF OOGONIA AND OOCYTES IN SILVER CARP. *Sov. J. Dev. Biol.(Engl. Transl. Ontogenez)* 10(2):126-132. Mar.-Apr. 1980. SFA 25(2)
[Dep. Ichthyol., Moscow Univ., USSR]

80-000884 Gilbert, P. W. STRUCTURE AND FUNCTION OF SHARK SIPHON SACS. *Fla. Sci.* 43(Suppl. 1):9. 1980. Abstract only. SFA 25(2)
[Div. Biol. Sci., Cornell Univ., Ithaca, NY 14853] With few exceptions (*Hexanchus griseus*, *Notorhynchus platycephalus*, and *Chlamydoselachus anguineus*) paired subcutaneous, muscular, epithelium-lined bladders, situated between the skin and belly musculature, known as siphon sacs appear in all species of male sharks thus far studied. The blind anterior end of each sac in mature orectolobid (*Hemiscyllium*, *Ginglymostoma*), carcharhinid (*Galeocerdo*, *Negaprion*, *Carcharhinus*) and triakid (*Mustela*) genera extends forward to the coracoid bar. Large goblet-like cells in the stratified epithelium lining the lumen of each sac secrete a clear viscous fluid which serves to lubricate the clasper. Each sac opens posteriorly, by an apopyle, into a clasper groove. Prior to copulation sea water is pumped into each siphon sac by repeated flexings of a clasper. After clasper insertion, sperm pass from the male urogenital papilla into the clasper groove and sea water expressed from the adjoining siphon sac washes the sperm up the oviduct.

80-000885 Grimm, H. VERÄNDERUNGEN IN DER VARIABILITÄT VON POPULATIONEN DES ZAHNKARPFENS *APHANIUS ANATOLIAE* (LEIDENFROST, 1912) WÄHREND 30 JAHREN: 1943-1974. [CHANGES IN THE VARIABILITY OBSERVED IN POPULATIONS OF THE CYPRINODONT *APHANIUS ANATOLIAE* OVER A PERIOD OF 30 YEARS: 1943-1974.] *Z. Zool. Syst. Evolutionsforsch.* 17(4):272-280. Dec. 1979. In German with English summ. SFA 25(2)
[Zool. Inst., Martin-Luther-King-Platz 3, D-2000 Hamburg 13, West Germany]

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80-000886 Hebrank, M. R. MECHANICAL PROPERTIES AND LOCOMOTOR FUNCTIONS OF EEL SKIN. *Biol. Bull. (Woods Hole)* 158(1):58-68. Feb. 1980. SFA 25(2)
[Dep. Zool., Duke Univ., Durham, NC 27706]

80-000887 Hirji, K. N. and W. A. M. Courtney. 'PEAR-SHAPED' CELLS IN THE DIGESTIVE TRACT OF THE PERCH *PERCA FLUVIATILIS* (L.). *J. Fish Biol.* 15(6):629-632. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. Dar es Salaam, P.O. Box 35064, Dar es Salaam, Tanzania]

80-000888 Hueter, R. E. and S. H. Gruber. RECENT ADVANCES IN STUDIES OF THE VISUAL SYSTEM OF THE JUVENILE LEMON SHARK *(NEGAPRION BREVIROSTRIS). Fla. Sci.* 43(Suppl. 1):10. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Fla., Gainesville 32611] Due to its phyletic position among the selachians, its relative abundance in Florida coastal waters, and its uncommon adaptability to laboratory conditions, the juvenile lemon shark is an excellent model for studies of the sensory biology of the "typical" shark. My investigations of the physiological optics of this shark's eye have resulted in a mathematical model, or schematic eye, for the species. This optical model is centered around an ellipsoidal lens of high overall equivalent refractive index (1.664) and principal power (140 Diopters), and yet all data indicate these animals to be hypermetropic (far-sighted) by about 3 Diopters or more in seawater, with no evidence of accommodation. Using the schematic eye, optical limitations on spatial vision of this shark are predictable. In addition to discussing the optics, I will briefly review recent findings on the functional and anatomical organization of the retina, as well as psychophysical measurements of absolute sensitivity, of the juvenile lemon shark.

80-000889 Kanno, Y. [ON THE LIFE HISTORY OF HERRING, *CLUPEA PALLASII* CUVIER ET VALENCIENNES, IN THE BRACKISH LAKE NOTORO, HOKKAIDO. I. THE COMPOSITION OF BODY LENGTH, VERTEBRAL NUMBERS AND THE TIME OF RING FORMATION ON THE SCALES.] *Bull. Fac. Fish. Hokkaido Univ.* 30(4):259-271. Nov. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Biol. Fish Popul., Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

80-000890 Kavaliers, M.; B. T. Firth and C. L. Ralph. PINEAL CONTROL OF THE CIRCADIAN RHYTHM OF COLOUR CHANGE IN THE KILLIFISH *(FUNDULUS HETEROCLITUS). Can. J. Zool.* 58(3):456-460. Mar. 1980. In English with French summ. SFA 25(2)
[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523] The killifish, *Fundulus heteroclitus*, displays a circadian rhythm of colour change (pigment aggregation and dispersion) under constant light and temperature conditions. Pinealectomy elimates the circadian rhythm of colour change but does not affect physiological colour change and background adaptation. Pineal control of the rhythm of colour change is interpreted as arising from the pineal's involvement in determining circadian organization.

80-000891 Kleckner, R. C. SWIMBLADDER WALL GUANINE ENHANCEMENT RELATED TO MIGRATORY DEPTH IN SILVER PHASE *ANGUILLA ROSTRATA. Comp. Biochem. Physiol. A Comp. Physiol.* 65(3):351-354. 1980. SFA 25(2)
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[Dep. Gen. Anat., Gifer Coll. Dent., 1851 Takano, Hozumi-cho, Motosu-gun, Gifer Pref., Japan]

80-000893 Kulkarni, G. M. ABNORMALITIES IN THE VERTEBRAL COLUMN OF INDIAN MACKEREL. *Indian J. Fish.* 23(1/2):269-270. 1976. SFA 25(2)
[Karwar Res. Cent. C.M.F.R. Inst., Karwar, India]

80-000894 Lal Mohan, R. S. and V. Gandhi. RECORD OF PACIFIC PARROT FISH *YPSISCARUS OEDEMA* (SNYDER) FROM GULF OF MANNAR. *Indian J. Fish.* 23(1/2):241-243. 1976. SFA 25(2)
[Mandapam Reg. Cent. C.M.F.R. Inst., Mandapam Camp, India]

80-000895 Lane, E. B. and M. Whitear. SKEIN CELLS IN LAMPREY EPIDERMIS. *Can. J. Zool.* 58(3):450-455. Mar. 1980. In English with French summ. SFA 25(2)
[Dep. Zool., Univ. Coll. London, Gower St., London WCIE 6BT, England] The fine structure of the so-called club cells in lamprey skin shows that they are modified basal layer epidermal cells and therefore are not homologous with the club cells of teleost skin which are unicellular secretory elements. It is proposed that the cell type in lampreys be renamed "skein cell"; this term is indicative of the structure. It is noted that tonofilaments in bundles are united into a meshwork by apparent adhesion between individual filaments, so enhancing their efficiency as a cytoskeleton. The function of the skein cells may be to provide support against distortion in the soft mucigenic epidermis and to protect the germinative cells.

80-000896 Lauder, G. V., Jr. THE ROLE OF THE HYOID APPARATUS IN THE FEEDING MECHANISM OF THE COELACANTH *LATIMERIA CHALUMNAE*. *Copeia* 1980(1):1-9. 1 Feb. 1980. SFA 25(2)
[Mus. Comp. Zool., Harvard Univ., Cambridge, MA 02138]

80-000897 Leino, R. L. THE EFFECTS OF PERIODIC ACID-SILVER METHENAMINE STAINING AND PROTEASE DIGESTION ON THE SECRETORY GRANULES OF RODLET CELLS. *Proc. Electron Micros. Soc. Am.* 37:310-311. 1979. SFA 25(2)
[Dep. Biomed. Anat., Sch. Med., Univ. Minn., Duluth 55812]

80-000898 Lesseps, R. J.; M. V. Lapeyre and M. V. Hall. TISSUE CULTURE EVIDENCE ON THE CONTROL OF THE SWITCH FROM CONTACT INHIBITION OF CELL MOVEMENT TO OVERLAPPING BEHAVIOR IN ANNUAL FISH EMBRYOS OF *NOTHOBRANCHIUS KORTHAUSAE*. *J. Exp. Zool.* 210(3):521-528. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., Loyola Univ., New Orleans, LA 70118]

80-000899 Lindquist, D. G. ASPECTS OF THE POLYCHROMATISM IN POPULATIONS OF THE GULF OF CALIFORNIA BROWNCHEEK BLENNY, *ACANTHEMBLEMARIA CROCKERI* (BLENNIOIDEA: CHAENOPSIDAE). *Copeia* 1980(1):137-141. 1 Feb. 1980. SFA 25(2)
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[Zool. Inst., Univ. Hamburg, West Germany]

80-000901 Mikulin, A. Ye.; V. V. Gerasimchuk and V. N. Dubrovin. PIGMENTATION OF THE EGGS OF THE LUMPFISH, *CYCLOPTERUS LUMPUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):816-821. 1978. SFA 25(2)
[Moscow Univ., USSR]

80-000902 Moiseyeva, Ye. B. A NEW MODIFICATION OF THE METHOD OF DIFFERENTIAL STAINING OF THE GLANDULAR CELLS OF THE ADENOHYPOPHYSIS OF FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1038-1039. 1978. SFA 25(2)
[AzCherNIRO, Kerch, USSR]

80-000903 Moreno, M. and B. J. Martin. EMBRYOLOGIC DEVELOPMENT OF THE SHEEPSHEAD MINNOW *(CYPRINODON VARIEGATUS)*. J. Miss. Acad. Sci. 24(Suppl.):116. 1979. Abstract only. SFA 25(2)
[Dep. Biol., Univ. South. Miss., Hattiesburg 39401]

80-000904 Morrison, C. M. A DENSE CELL IN THE EPITHELIUM OF THE GILL LAMELLAE OF THE BROOK TROUT, *SALVELINUS FONTINALIS* (MITCHELL). *J. Fish Biol.* 15(5):601-605. Nov. 1979. SFA 25(2)
[Fish. Mar. Serv., Halifax Lab., P.O. Box 550, Halifax, NS B3J 3S7, Canada] A cell was found in freshwater brook trout which was similar to a chloride cell as it was mitochondria-rich with an extensive tubular network, but differed in having a dark cytoplasm, large round vesicles in the apical cytoplasm, and large membrane-bound bodies near the nucleus. The base of the cell was separated from the basement membrane by cytoplasm from another epithelial cell. The cell was more rarely found in trout adapted to brackish water and salt water.

80-000905 Nelichik, V. A. MORPHOMETRIC FEATURES OF THE BURBOT, *LOTA LOTA*, OF THE UPPER TULOMA RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):756-764. 1978. SFA 25(2)
[PINRO, Murmansk, USSR] On the basis of research on the morphological characters of the burbot, *Lota lota*, it is shown that this species in the Upper Tuloma reservoir is represented by two ecological forms: the lake form and the lake-river form. The morphological variability of the burbot living in different waters is compared.

80-000906 Nicol, J. A. C. STUDIES ON THE EYES OF TOADFISHES *OPSANUS*. STRUCTURE AND REFLECTIVITY OF THE STRATUM ARGENTEUM. *Can. J. Zool.* 58(1):114-121. Jan. 1980. In English with French summ. SFA 25(2)
[Mar. Sci. Lab., Univ. Tex., Port Aransas 78373]

80-000907 Ovcharov, O. P. THE VARIABLE GEOMETRY OF THE CAUDAL FIN OF THE PORGY, *SPICARA SMARIS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):863-866. 1978. SFA 25(2)
[Inst. Biol. South. Seas, Ukrainian Acad. Sci., Sevastopol, USSR]

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The feeding mechanism of *Macrorhamphosus gracilis* is unique in having a hyoid locking mechanism to increase the speed of buccal cavity expansion. Function of this lock is dependent upon dorsal rotation of the head by specially modified epaxial muscles, and anterodorsal rotation of the hyoid arch by the protractor hyoidei muscle. The modifications of the anterior epaxial muscles include: 1) lack of myosepta; 2) parallel arrangement of the elongate fibers; 3) division into two bundles of fibers; and 4) lack of attachment to the vertebral column. Additional pertinent myological and osteological features of the feeding mechanism are presented and discussed.

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[Dep. Zoophysiol., Univ. Göteborg, Sweden] Effects of adrenergic and cholinergic drugs were studied on isolated preparations from the heart, the

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80-000934 CONTINUED lung and the spleen of the African lungfish. In addition, a nerve-lung preparation was employed for the study of the autonomic nervous control of the lung. Falck-Hillarp fluorescent histochemistry was used in the search for adrenergic neurons in the sympathetic chain and tissues. The *Protopterus* lung received a cholinergic excitatory innervation via the pulmonary branches of the vagi. The presence of parasympathetic ganglia in the lung tissue is indicated. Adrenergic drugs, when producing a response, either contracted or relaxed lung strips. Spleen strips were contracted by cholinergic drugs acting on muscarinic receptors and, to a lesser extent, by adrenergic drugs. A strong negative inotropic effect was produced by carbachol on paced atrial but not ventricular strips, while adrenaline increased the contraction force in ventricular but not atrial strips. The sympathetic ganglion cells did not contain enough catecholamines to give off any visible fluorescence, nor was it possible to show any adrenergic nerve terminals in the tissues studied. It is concluded that the adrenergic control in the lungfish is mainly due to circulating catecholamines, rather than adrenergic nerve fibres, since concentrations of catecholamines in *Protopterus* plasma are high enough to affect the spleen, lung and ventricle.

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[Dep. Biol. Sci., Univ. Dundee, Dundee DD1 4HN, Scotland] Physiological responses of rainbow trout (mean weight 13.3 g) to sudden changes in salinity were investigated. An initial period lasting about 8 h was characterized by increased drinking and an increase in plasma and body ions. Fish failed to survive more than 2 days in full strength sea water but in two-thirds sea water there were few mortalities and adaptation was complete in 7-10 days. During this period there were gradual physiological changes resulting in normal plasma ion concentrations but significantly increased body ionic content. The intracellular concentrations of muscle chloride showed the greatest increase.

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[Dep. Anat., Univ. Coll., Cardiff, Wales]

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[Dep. Zool., Univ. Lund, Lund, Sweden]

80-000951 Bouck, G. R. CONCENTRATIONS OF LEUCINE AMINONAPHTHYLAMIDASE (LAN) AND SOLUBLE PROTEIN IN TISSUES OF RAINBOW TROUT, *SALMO GAIRDNERI*. *Can. J. Fish. Aquatic Sci.* 37(1):116-120. Jan. 1980. In English with French summ. SFA 25(2)
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80-000952 Breepoel, P. M.; F. Kreuzer and M. Hazevoet. STUDIES OF THE HEMOGLOBINS OF THE EEL (*ANGUILLA ANGUILLA* L.)--I. PROTON BINDING OF STRIPPED HEMOLYSATE; SEPARATION AND PROPERTIES OF TWO MAJOR COMPONENTS. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(1):69-75. 1980. SFA 25(2)
[Dep. Physiol., Fac. Med., Catholic Univ., Nijmegen, The Netherlands]

80-000953 Brill, R. W. and A. E. Dizon. RED AND WHITE MUSCLE FIBRE ACTIVITY IN SWIMMING SKIPJACK TUNA, *KATSUWONUS PELAMIS* (L.). *J. Fish Biol.* 15(6):679-685. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. British Columbia, 2075 Wesbrook Mall, Vancouver, BC V6T 1W5, Canada] To test the hypothesis that white muscle fibre portions of the myotomes are used at sustainable swimming speeds, skipjack tuna, *Katsuwonus pelamis*, were forced to swim against various current velocities in a water tunnel while electrical activity of the red and white muscle fibres was simultaneously recorded. Eight fish were tested, five fish graded white muscle fibres into activity at swimming speeds above their minimum hydrostatic equilibrium speed, but well below the estimated maximum sustainable swimming speed of skipjack tuna. Three other fish showed white muscle fibre activity at minimum swimming speeds, a possibly abnormal condition.

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[Biol. Fac., Moscow Univ., USSR]

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[Acad. Nat. Sci. Phila., Benedict Estuarine Res. Lab., Benedict, MD 20612] Ventilation frequency patterns of *Trinectes maculatus*, *Morone americana* and *Leiostomus xanthurus* were used to evaluate potential thermal stress after exposure to moderate temperature increases. Fish acclimated to 5°, 15° and 25°C were exposed to 5°CΔT; fish acclimated to 30°C were exposed to a 2.5°CΔT. Ventilation frequencies were measured at each acclimation temperature before the fishes were exposed over a 15-min period to the increased temperatures. Ventilation rates were then measured at the elevated temperatures for the next 24 h. Significant increases in rate frequency occurred after the temperature increases in *T. maculatus* and *M. americana* acclimated to 5°, 15°, 25°C and in *L. xanthurus* acclimated to 15°, 25° and 30°C. In general, rate frequencies increased as the temperature increased. Ventilation rates stabilized quickly at the higher temperatures and remained relatively constant throughout the remaining exposure period. Acclimated rate-temperature curves (R-T curves), acute R-T curves and Q_{10} temperature coefficients used to assess the significance of the changes in rate frequency and to compare the species in an ecologically meaningful way, showed that several adaptive types occurred among and between species. The Q_{10}'s of the acute R-T curves, in most cases, were found to approximate those values derived for the acclimated R-T curve. This suggests that the temperature increases had a negligible effect, that is, little or no thermal stress occurred.

80-000959 Burton, D. T.; P. R. Abell and T. P. Capizzi. COLD SHOCK: EFFECT OF RATE OF THERMAL DECREASE ON ATLANTIC MENHADEN. *Mar. Pollut. Bull.* 10(12):347-349. Dec. 1979. SFA 25(2)
[Acad. Nat. Sci. Phila., Benedict Estuarine Res. Lab., Benedict, MD 20612] This study was designed to assess the effects of various rates of thermal decrease on mortality of juvenile Atlantic menhaden (*Brevoortia tyrannus*) which may result from winter shutdown of large power plant facilities. Temperatures were lowered from 15 to 5°C at rates of decrease which ranged from 27.0 to 0.4°C/h. A significant correlation was found between rate of thermal decrease and mortality. The relationship between percent mortality and rate of decrease was best described by a piecewise regression curve with two rates; one rate where mortality was high and a second where mortality decreased rapidly as the rate of temperature reduction decreased.

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[Lab. Physiol., CNRS Mus., Paris, France]

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[Fisiol. Dep., Fac. Biol., Univ. Barcelona, Spain]

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[Dep. Zool., Univ. Adelaide, Adelaide, South Australia 5000]

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[Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1C 5S7, Canada]

80-000965 Daye, P. G. and E. T. Garside. DEVELOPMENT, SURVIVAL, AND STRUCTURAL ALTERATIONS OF EMBRYOS AND ALEVINS OF ATLANTIC SALMON, *SALMO SALAR* L., CONTINUOUSLY EXPOSED TO ALKALINE LEVELS OF pH, FROM FERTILIZATION. *Can. J. Zool.* 58(3):369-377. Mar. 1980. In English with French summ. SFA 25(2)
[Fish. Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Embryos of the Atlantic salmon, *Salmo salar* L., were incubated continuously from fertilization at pH 6.8 (control) and pH 9.0 and 9.5, initially at 6.7°C but with a gradual decline in the first 5 weeks to 5.0°C for the remaining 10 weeks of exposure. Subsequently, the alevins were maintained in these environments for 50 days after hatching. Developmental processes and hatching were not affected by these levels of pH. Percentage cumulative mortality of treated embryos, 8%, was approximately that in the controls. Alevin mortality in the control lots was 1.2 and 1.3%. At pH 9.0, cumulative mortality was 0.4%, but at pH 9.5 there was an accelerating increase to 18%, at the termination of observation. Sublethal changes in embryos were confined mostly to cell necrosis and sloughed rudimentary epidermis. Some metaplasia of the brain stem occurred at pH 9.5. Sites and intensity of alterations increased in alevins at pH 9.5, following the loss of the zona radiata. In addition to ongoing injury of epidermis, including mucous cells, deleterious alterations occurred in brachial epithelium, erythrocytes, myocardium, blood vessels of the viscera, liver, brain, and optic lenses. In general, sublethal changes caused by hydroxyl ions are similar to those caused by excessive hydrogen ions but are somewhat less extensive in the structures affected or in their degree of severity.

80-000966 de Ruiter, A. J. H. CHANGES IN GLOMERULAR STRUCTURE AFTER SEXUAL MATURATION AND SEAWATER ADAPTATION IN MALES OF THE EURYHALINE TELEOST *GASTEROSTEUS ACULEATUS* L. *Cell Tissue Res.* 206(1):1-20. Feb. 1980. SFA 25(2)
[Dep. Zool., State Univ. Groningen, P.O. Box 14, 9750 AA Haren, The Netherlands]

80-000967 de Vlaming, V. EFFECTS OF PINEALECTOMY AND MELATONIN TREATMENT ON GROWTH IN THE GOLDFISH, *CARASSIUS AURATUS*. *Gen. Comp. Endocrinol.* 40(2):245-250. Feb. 1980. SFA 25(2)
[Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

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80-000968 Delahunty, G. and V. L. de Vlaming. SEASONAL RELATIONSHIPS OF OVARY WEIGHT, LIVER WEIGHT AND FAT STORES WITH BODY WEIGHT IN THE GOLDFISH, *CARASSIUS AURATUS*. *J. Fish Biol.* 16(1):5-13. Jan. 1980. SFA 25(2)
[V. L. de Vlaming: Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

80-000969 Delahunty, G. B. ENVIRONMENTAL EFFECTS ON THE METABOLISM OF *CARASSIUS AURATUS*: ROLE OF THE PINEAL ORGAN AND RETINAL PATHWAYS. *Ph.D. dissertation, Marquette Univ.* 139p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4082. Mar. 1980. SFA 25(2)

80-000970 Delahunty, G.; C. B. Schreck and V. L. de Vlaming. EFFECTS OF PHOTOPERIOD ON PLASMA CORTICOID LEVELS IN THE GOLDFISH, *CARASSIUS AURATUS*--ROLE OF THE PINEAL. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(3):355-358. 1980. SFA 25(2)
[Dep. Biol., Marquette Univ., Milwaukee, WI 53233]

80-000971 Dodd, J. M.; M. H. I. Dodd and N. Jenkins. PRESENCE OF GONADOTROPHIN IN THE RACHENDACHHYPOPHYSE OF THE PITUITARY GLAND OF THE RABBIT FISH *HYDROLAGUS COLLIEI* (CHONDRICHTHYES: HOLOCEPHALI). *Gen. Comp. Endocrinol.* 40(3):342-343. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Coll. North Wales, Bangor, Gwynedd, Wales]

80-000972 Dunant, Y.; L. Eder and L. Servetiadis-Hirt. ACETYLCHOLINE RELEASE EVOKED BY SINGLE OR A FEW NERVE IMPULSES IN THE ELECTRIC ORGAN OF *TORPEDO*. *J. Physiol. (Lond.)* 298:185-203. Jan. 1980. SFA 25(2)
[Dep. Pharmacol., Ecol. Med., 20, 1211 Genève 4, Switzerland]

80-000973 Eddy, F. B. and R. N. Bath. IONIC REGULATION IN RAINBOW TROUT (*SALMO GAIRDNERI*) ADAPTED TO FRESH WATER AND DILUTE SEA WATER. *J. Exp. Biol.* 83:181-192. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., Univ. Dundee, Dundee, DD1 4HN, Scotland] Small rainbow trout (5-20 g) adapt to salinities of up to at least 22°/oo but not to full strength sea water. In adapted fish plasma ions are regulated near the fresh water values, but there is an ionic invasion of the tissues, particularly by Cl^- in muscle cells. Analysis of ionic regulation in adapted fish indicates that balance is maintained mainly by expending energy on Cl^- regulation. Fish in full strength sea water can no longer regulate Na^+ or Cl^- in plasma or tissues, which results in high tissue concentrations of these ions and eventual death.

80-000974 Eddy, F. B.; G. R. Smart and R. N. Bath. IONIC CONTENT OF MUSCLE AND URINE IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON KEPT IN WATER OF HIGH CO_2 CONTENT. *J. Fish Dis.* 2(2):105-110. Mar. 1979. SFA 25(2)
[F. B. Eddy: Dep. Biol. Sci., Univ. Dundee, Dundee DD1 4HN, Scotland]

80-000975 Epler, P; E. Marosz and K. Bieniarz. EFFECT OF TELEOST PITUITARY GONADOTROPINS ON THE IN VITRO MATURATION OF CARP OOCYTES. *Aquaculture* 18(4):379-382. Dec. 1979. SFA 25(2)
[Inst. Appl. Zool., Acad. Agric., Krakow, Poland] Studies were conducted on the effects of various kinds of teleost pituitary gonadotropin on the in vitro maturation of carp oocytes. It was ascertained that after 24 h of

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80-000975 CONTINUED incubation with gonadotropins, the highest percentage of oocytes with the nucleus in the migrating or peripheral position, or of mature oocytes, was observed in the case of ciprinide gonadotropins. Centrifuged hypophysial homogenates of the pike, sea-trout and pike-perch displayed a considerably weaker activity. The results obtained are indicative of a specificity of teleost pituitary gonadotropins.

80-000976 Epple, A. and J. J. Kocsis. THE EFFECTS OF PANCREATECTOMY ON TISSUE TAURINE OF THE AMERICAN EEL UNDER VARYING OSMOTIC AND NUTRITIONAL CONDITIONS. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(1):139-142. 1980. SFA 25(2)

[Jefferson Med. Coll., Thomas Jefferson Univ., Philadelphia, PA 19107]

80-000977 Eveloff, J.; M. Field; R. Kinne and H. Murer. SODIUM-COTRANSPORT SYSTEMS IN INTESTINE AND KIDNEY OF THE WINTER FLOUNDER. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 135(2):175-182. 1980. SFA 25(2)

[Albert Einstein Coll. Med., Dep. Physiol., 1300 Morris Park Ave., Bronx, NY 10461]

80-000978 Ewing, R. D.; H. J. Pribble; S. L. Johnson; C. A. Fustish; J. Diamond and J. A. Lichatowich. INFLUENCE OF SIZE, GROWTH RATE, AND PHOTOPERIOD ON CYCLIC CHANGES IN GILL (Na + K)-ATPase ACTIVITY IN CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*). *Can. J. Fish. Aquatic Sci.* 37(4):600-605. Apr. 1980. SFA 25(2)

[Oreg. Dep. Fish Wildl., 303 Extension Hall, Oreg. State Univ., Corvallis 97331]

80-000979 Febinger, D. L. OVERWINTERING AND ENERGY SOURCES FOR FISHES IN A COLORADO MOUNTAIN STREAM. *J. Colo.-Wyo. Acad. Sci.* 12(1):16. Apr. 1980. Abstract only. SFA 25(2)

[Dep. Biol., Univ. Colo., Boulder] Studies of fishes under winter conditions in a front range mountain stream are being conducted to better understand the effects of cold temperatures and ice on population structure and individual physiological adjustments to these environmental factors. Two sections of Left-Hand Creek, Boulder County are being investigated: an unstocked third order section, 7 km. east of Ward, elevation 2400 m., which supports a large population of brook trout, *Salvelinus fontinalis* (3900 ind./surf. ha.) and a lower, fourth order section, elevation 1900 m., with small late-autumn populations of stocked rainbow trout *Salmo gairdneri* (43 ind./surf. ha.), resident rainbows and longnose suckers, *Catostomus catostomus* (86 ind./surf. ha.). Late-fall brook trout populations were made up of many small, non-feeding individuals in relatively poor condition (CF=1.01), with low fat reserves whereas rainbows were actively feeding, in good condition (CF=1.40) with much visceral fat. Mean condition factor for rainbows through February did not change while for brooks it showed a slight downward trend and for suckers, which also were feeding, a change from 1.24 (Oct.) to 1.09 (Feb.). Rainbows had a higher fat/dry weight ratio (0.25) than did brooks and suckers (0.10) but no significant changes in this parameter have been observed for any species through February. Data on condition factors and body composition will be collected through early May along with spring population information to give a more complete picture of overall effects of a winter season.

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80-000980 Fields, R. D. and G. D. Lange. ELECTRORECEPTION IN THE RATFISH (*HYDROLAGUS COLLIEI*). *Science* 207(4430):547-548. 1 Feb. 1980. SFA 25(2)
[Mar. Neurobiol. Unit, A-001, Scripps Inst. Oceanogr., La Jolla, CA 92093] Behavioral and neurophysiological experiments and anatomical work indicate that the ampullar structures on the head of fish of the subclass Holocephali are sense organs responsive to weak electric fields and are functionally and structurally homologous to the ampullae of Lorenzini in elasmobranchs. It is concluded that, as in elasmobranchs, these organs are used to detect bioelectric and other natural electric phenomena in the environment.

80-000981 Follenius, E. and M. P. Dubois. ANTI-α-ENDORPHIN- AND ANTI-MET-ENKEPHALIN-POSITIVE PATHWAYS IN THE BRAIN AND PITUITARY OF CARP. *Gen. Comp. Endocrinol.* 40(3):353. Mar. 1980. Abstract only. SFA 25(2)
[Lab. Cytol. Anim., ERA 492 CNRS ULP Strasbourg, France]

80-000982 Folmar, L. C. SOME PHYSIOLOGICAL CHANGES IN COHO SALMON [*ONCORHYNCHUS KISUTCH*] DURING SMOLTIFICATION AND SEAWATER ADAPTATION. *Ph.D. dissertation, Univ. Wash.* 163p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4048. Mar. 1980. SFA 25(2)

80-000983 Ford, D. S. and R. W. Gauldie. BLOOD GROUP ANTIGEN/ANTIBODY REACTIONS OF SOME NEW ZEALAND FISHES. *N.Z. J. Mar. Freshwater Res.* 13(2):273-276. 1979. SFA 25(2)
[R. W. Gauldie: Fish. Res. Div., Minist. Agric. Fish., P.O. Box 19-062, Wellington, New Zealand] The frequency of red blood cell antigens in the spiny dogfish, *Squalus acanthias*, was shown to be not statistically different from that described for fish from the Gulf of Maine, U.S.A. Five other species of fish in New Zealand waters, snapper (*Chrysophyrs auratus*), barracouta (*Thyrsites atum*), gurnard (*Trigla kumu*), red cod (*Pseudophycis bacchus*), and tarakihi (*Cheilodactylus macropterus*) were shown to carry antibodies that may be useful reagents in defining stocks of fish on the basis of red blood cell antigen frequency.

80-000984 Foucher, R. P. and R. J. Beamish. PRODUCTION OF NONVIABLE OOCYTES BY PACIFIC HAKE (*MERLUCCIUS PRODUCTUS*). *Can. J. Fish. Aquatic Sci.* 37(1):41-48. Jan. 1980. In English with French summ. SFA 25(2)
[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

80-000985 Fouda, M. M. STUDIES ON SCALE REGENERATION IN THE COMMON GOBY, *POMATOSCHISTUS MICROPS* (PISCES). *J. Zool. (Lond.)* 189(4):503-522. Dec. 1979. SFA 25(2)
[Dep. Zool., Fac. Sci., Al-Azhar Univ., Cairo, Egypt]

80-000986 Foulley, M.-M. and J. Mellinger. LA DIFFUSION DE L'EAU TRITÉE, DE L'URÉE-^{14}C ET D'AUTRES SUBSTANCES À TRAVERS LA COQUE DE L'OEUF DE ROUSSETTE, *SCYLIORHINUS CANICULA*. [DIFFUSION OF TRITIATED WATER, ^{14}C-UREA AND OTHER COMPOUNDS ACROSS THE EGG SHELL OF THE SMALL SPOTTED DOGFISH, *SCYLIORHINUS CANICULA*.] *C. R. Hebd. Séances Acad. Sci. Sér. D Sci. Nat.* 290(5):427-430. 4 Feb. 1980. In French with English summ. SFA 25(2)
[Univ. Reims, Lab. Biol. Anim., Fac. Sci., 51100 Reims, France]

80-000987 Freadman, M. A. SWIMMING ENERGETICS OF STRIPED BASS (*MORONE SAXATILIS*) AND BLUEFISH (*POMATOMUS SALTATRIX*): GILL VENTILATION AND SWIMMING METABOLISM. *J. Exp. Biol.* 83:217-230. Dec. 1979. SFA 25(2)
[John B. Pierce Found., Yale Univ., 290 Congress Ave., New Haven, CT 06519]

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80-000988 Fryer, J. N. and H. A. Bern. GROWTH HORMONE BINDING TO TISSUES OF NORMAL AND STUNTED JUVENILE COHO SALMON, *ONCORHYNCHUS KISUTCH*. *J. Fish Biol.* 15(5):527-533. Nov. 1979. SFA 25(2)

[Dep. Anat., Fac. Med., Univ. Ottawa, Ottawa, ON K1N 9A9, Canada] The premature transfer of juvenile Coho salmon into seawater results in high mortality and a reduction of growth (stunting) of a significant portion of the population while the remainder of the salmon continue to grow normally. Binding studies were conducted with ^{125}I-labelled tilapia (*Sarotherodon mossambicus*) growth hormone (tGH) to determine if differences in specific binding of tGH existed in membrane preparations of tissues of stunted and normal coho salmon. Membrane preparations of both liver and gill of stunted salmon obtained from stocks in California, Washington and British Columbia and kidney membrane preparations obtained from stunted salmon in California exhibited deficiencies in ^{125}I-labelled tGH-binding sites compared to corresponding membrane preparations of normal smolt. These results indicate that stunted coho salmon have a decreased ability to bind GH which may be reflected in perturbations in GH-mediated processes.

80-000989 Gemelli, L.; G. Martino and B. Tota. OXIDATION OF LACTATE IN THE COMPACT AND SPONGY MYOCARDIUM OF TUNA FISH (*THUNNUS THYNNUS THYNNUS* L.). *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2):321-326. 1980. SFA 25(2)

[B. Tota: Stoz. Zool., Villa Communale, 80121, Napoli, Italy]

80-000990 Giles, M. A. and D. J. Randall. OXYGENATION CHARACTERISTICS OF THE POLYMORPHIC HEMOGLOBINS OF COHO SALMON (*ONCORHYNCHUS KISUTCH*) AT DIFFERENT DEVELOPMENTAL STAGES. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(3):265-271. 1980. SFA 25(2)

[Freshwater Inst., 501 University Crescent, Winnipeg, MB R3T 2N6, Canada] The oxygen equilibria of the multiple hemoglobin of the fry and adult life stages of coho salmon (*Oncorhynchus kisutch*) were investigated. Components A6-8 comprise 50-55% and >95% of the total hemoglobins of coho adults and fry respectively. Fry hemoglobins exhibited a high oxygen affinity (P_{50} = 3.9 mm Hg at 9.8°C, pH 8.5, a very large Bohr shift ($\phi = \Delta \log P_{50}/\Delta pH$ = -1.729 at pH 7.1-7.5) which was non-linear in the pH range 6.8-8.5 and a large heat of oxygenation (ΔH = -20.8 kcal/mol). Adult hemoglobins, however, exhibited a moderate oxygen affinity (P_{50} = 14.0 mm Hg at 9.8°C, pH 8.2), a very small linear Bohr shift (ϕ = -0.172 at pH 7.0 - 8.2) and a low heat of oxygenation (ΔH = -5.6 - -7.5 kcal/mol). Adenosine triphosphate had only minor influence on the oxygenation characteristics of adult heolyzates. The results are discussed in terms of function adaptation to environmental stresses and metabolic requirements.

80-000991 Giovane, A.; G. Greco; A. Maresca and B. Tota. MYOGLOBIN IN THE HEART VENTRICLE OF TUNA AND OTHER FISHES. *Experientia (Basel)* 36(2):219-220. 15 Feb. 1980. SFA 25(2)

[B. Tota: Stazione Ecol., Villa Comunale, I-80121 Napoli, Italy] The myoglobin content in the hearts of several fishes is positively correlated with the ecological physiology of the species. In the tuna heart, where the highest myoglobin values are found, the logarithmic relationship between myoblobin content and body weight is reported.

80-000992 Goddard, C. I. THE EFFECT OF PHOTOPERIOD ON THE SEASONAL FLUCTUATIONS OF THE BROOK TROUT. *Ph. D. dissertation, York Univ. (Canada)* 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2486. Dec. 1979. SFA 25(2)

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80-000993 Goncharov, B. F.; E. Burzawa-Gerard and A. A. Kuznetsov. A STUDY ON THE HETEROGENEITY OF THE PITUITARY GONADOTROPIN FROM STURGEON (*ACIPENSER STELLATUS* PALL). *Gen. Comp. Endocrinol.* 40(3):342. Mar. 1980. Abstract only. SFA 25(2)
[Inst. Dev. Biol., Acad. Sci., Moscow, USSR]

80-000994 Goswani, A. K. ORGANIC COMPOSITION OF EYE LENS OF *CATLA CATLA* AT DIFFERENT STAGES OF GROWTH. *Indian J. Fish.* 23(1/2):238-240. 1976. SFA 25(2)
[Dep. Chem., K. R. Coll., Mathura, U.P., India]

80-000995 Hamoir, G. and N. Gerardin-Otthiers. DIFFERENTIATION OF THE SARCOPLASMIC PROTEINS OF WHITE, YELLOWISH AND CARDIAC MUSCLES OF AN ANTARCTIC HEMOGLOBIN-FREE FISH, *CHAMPSOCEPHALUS GUNNARI*. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2):199-206. 1980. SFA 25(2)
[Lab. Biochem. Musculaire, Inst. Chim., Univ. Liège, Sart Tilman, B-4000 Liège, Belgium]

80-000996 Hanyu, I.; K. Tsukamoto; K. Yamamori; P. V. Ngan; K. Furukawa and T. Hibiya. SIMULTANEOUS RECORDING OF PHYSIOLOGICAL INFORMATION FROM SWIMMING FISH. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1261-1265. Oct. 1979. SFA 25(2)
[Fac. Agric., Univ. Tokyo, Bunkyo-ku, Tokyo, Japan]

80-000997 Hara, A.; K. Yamauchi and H. Hirai. STUDIES ON FEMALE-SPECIFIC SERUM PROTEIN (VITELLOGENIN) AND EGG YOLK PROTEIN IN JAPANESE EEL (*ANGUILLA JAPONICA*). *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2):315-320. 1980. SFA 25(2)
[Dep. Biochem., Hokkaido Univ. Sch. Med., Sapporo, Japan]

80-000998 Harache, Y.; G. Boeuf and P. Lasserre. OSMOTIC ADAPTATION OF *ONCORHYNCHUS KISUTCH* WALBAUM. III. SURVIVAL AND GROWTH OF JUVENILE COHO SALMON TRANSFERRED TO SEA WATER AT VARIOUS TIMES OF THE YEAR. *Aquaculture* 19(3):253-273. Mar. 1980. SFA 25(2)
[Cent. Oceanol. Bretagne (CNEXO), B.P. 337, 29273 Brest Cedex, France] Juvenile salmon from two successive broods (1974 and 1975 spawnings) were transferred to sea water of various salinities at different periods of the year in 1976 to determine the tolerance to sea water in terms of mortality and growth. Fish of the 0^{+} age group, transferred directly to sea water ($35^{o}/oo$) on 23 June (19.5 ± 3.3 g) and 13 July (27.1 ± 2.4 g) very rapidly showed an extremely high mortality. Progressive adaptation performed at the same dates indicated a higher tolerance in June compared to the July transfer, but still with significant mortalities. Direct transfers made between September and December with subyearlings showed a better adaptability in September-October than later. Yearling fish put in sea water on 3 March (68.3 ± 0.8 g) and 14 April (98.0 ± 2.4 g) had a vary low 30-days mortality after contact with sea water of various salinities ($25\text{-}30\text{-}35\ ^{o}/oo$). However, growth assessment indicated better osmotic adaptation in April whereas the fish transferred in March showed a much lower average growth. The results suggest that the 30-day survival criterion alone is not sufficient to characterize a good osmotic adaption to the marine environment. The simultaneous examination of growth and mortality data gives a more precise estimation of the tolerance to sea water. This study provided information on the seasonal variations of this tolerance to

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80-000998 CONTINUED high salinities, and defined the minimum sizes required for a satisfactory adaptation. It is interesting to note that the periods of highest euryhalinity (April-June and September-October) correspond to the phases of highest gill Na^+-K^+ ATPase activity described in an earlier paper.

80-000999 Hashimoto, K.; S. Watabe; M. Kono and K. Shiro. MUSCLE PROTEIN COMPOSITION OF SARDINE AND MACKEREL. *Bull. Jpn. Soc. Sci. Fish.* 45(11):1435-1441. Nov. 1979. SFA 25(2)
[Lab. Mar. Biochem., Fac. Agric., Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan]

80-001000 Hashimoto, K.; K. Yamaguchi; N. Takeda and K. Ogawa. [DISTRIBUTION OF HEMOPROTEIN IN THE MUSCLES OF MACKEREL AND SARDINE]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1331-1333. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Mar. Biochem., Fac. Agric., Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan]

80-001001 Hazel, J. R. and C. L. Prosser. INCORPORATION OF 1-^{14}C-ACETATE INTO FATTY ACIDS AND STEROLS BY ISOLATED HEPATOCYTES OF THERMALLY ACCLIMATED RAINBOW TROUT (*SALMO GARDNERI*). *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 134(4):321-329. Dec. 1979. SFA 25(2)
[Dep. Zool., Ariz. State Univ., Tempe 85281]

80-001002 Herold, J. P.; J. Cl. Pierron; L. Henquell; G. Cudey and J. P. Maurat. DÉTERMINATION DU RENDEMENT THERMODYNAMIQUE DU COEUR ISOLÉ ET PERFUSÉ DE TANCHE (*TINCA TINCA* L. TÉLÉSOTÉEN). [THERMODYNAMIC EFFICIENCY OF THE ISOLATED AND PERFUSED TENCH HEART (*TINCA TINCA* L. TELEOST).] *C.R. Séances Soc. Biol. Fil.* 173(3):563-568. 1979. In French with English summ. SFA 25(2)
[Lab. Physiol. Anim., Fac. Sci., Route de Gray, Univ. Franche Comté, 25030 Besancon Cedex, France]

80-001003 Hirano, T.; H. Nakamura and M. Suyama. [QUALITY OF WILD AND CULTURED AYU--II. SEASONAL VARIATION OF PROXIMATE COMPOSITION.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):75-78. Jan. 1980. In Japanese with English summ. SFA 25(2)
[Tokyo Univ. Fish., 5-7, Konan 4, Minato-ku, Tokyo 108, Japan]

80-001004 Holcombe, R. F.; D. W. Wilde and D. F. Opdyke. VASOMOTOR TONE IN THE DOGFISH SHARK. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(1):135-138. 1980. SFA 25(2)
[Mt. Desert Island Biol. Lab., Salsbury Cove, ME 04672]

80-001005 Hontela, A. and R. E. Peter. EFFECTS OF PINEALECTOMY, BLINDING, AND SEXUAL CONDITION ON SERUM GONADOTROPIN LEVELS IN THE GOLDFISH. *Gen. Comp. Endocrinol.* 40(2):168-179. Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Alberta, Edmonton T6G 2E9, Canada]

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80-001006 Hyder, M.; A. V. Shah and A. S. Hartree. METHALLIBURE STUDIES ON TILAPIA. III. EFFECTS OF TILAPIAN PARTIALLY PURIFIED PITUITARY GONADOTROPHIC FRACTIONS ON THE TESTES OF METHALLIBURE-TREATED *SAROTHERODON SPIRULUS* (=*Tilapia nigra*). *Gen. Comp. Endocrinol.* 39(4):475-480. Dec. 1979. SFA 25(2)
[Gecaga Inst. Trop. Comp. Endocrinol., Dep. Zool., Univ. Nairobi, Nairobi, Kenya]

80-001007 Iga, T. BLOCKADE OF ALPHA ADRENERGIC RECEPTORS IN FISH MELANOPHORES BY A SULFHYDRYL INHIBITOR, MERSALYL. *Annot. Zool. Jpn.* 52(3):151-156. Sept. 1979. SFA 25(2)
[Dep. Biol., Fac. Sci., Shimane Univ., Matsue, Shimane 690, Japan]

80-001008 Iijima, N. and K. Zama. [INFLUENCE OF OXIDIZED LIPIDS ON THE LIPID METABOLISM IN THE FISH. II. ABSORPTION AND METABOLISM OF PALMITIC ACID-1-^{14}C IN CARP FED WITH OXIDIZED LIPIDS]. *Bull. Fac. Fish. Hokkaido Univ.* 30(1):84-91. Feb. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Food Chem., Fac. Fish., Hokkaido Univ., Hakodate, Japan]

80-001009 Ince, B. W. AMINO ACID STIMULATION OF INSULIN SECRETION FROM THE *IN SITU* PERFUSED EEL PANCREAS: MODIFICATION BY SOMATOSTATIN, ADRENALINE, AND THEOPHYLLINE. *Gen. Comp. Endocrinol.* 40(3):275-282. Mar. 1980. SFA 25(2)
[Dep. Zool. Comp. Physiol., Queen Mary Coll., London Univ., Mile End Road, London E1 4NS, England]

80-001010 Isaacks, R. E. and D. R. Harkness. ERYTHROCYTE ORGANIC PHOSPHATES AND HEMOGLOBIN FUNCTION IN BIRDS, REPTILES, AND FISHES. *Am. Zool.* 20(1):115-129. 1980. SFA 25(2)
[Res. Lab. Vet. Admin. Med. Cent., Univ. Miami, Miami, FL 33125]

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[Off. Environ. Plan., N.Y. State Dep. Pub. Serv., 3 Rockefeller Plaza, Albany 12223]

80-001012 Jenkins, N.; J. P. Joss and J. M. Dodd. BIOCHEMICAL AND AUTORADIOGRAPHIC STUDIES ON THE OESTRADIOL-CONCENTRATING CELLS IN THE DIENCEPHALON AND PITUITARY GLAND OF THE FEMALE DOGFISH (*SCYLIORHINUS CANICULA* L.). *Gen. Comp. Endocrinol.* 40(2):211-219. Feb. 1980. SFA 25(2)
[Dep. Steroid Biochem., Royal Postgrad. Med. Sch., DuCane Rd., London W.12, England]

80-001013 Johnston, I. A. and T. W. Moon. ENDURANCE EXERCISE TRAINING IN THE FAST AND SLOW MUSCLES OF A TELEOST FISH (*POLLACHIUS VIRENS*). *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 135(2):147-156. 1980. SFA 25(2)
[Dep. Physiol., Univ. St. Andrews, St. Andrews, Fife, UK]

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[Dep. Agric. Chem., Tokyo Univ. Agric., Setagaya-ku 156, Tokyo, Japan]

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80-001015 Kavaliers, M. THE PINEAL ORGAN AND CIRCADIAN ORGANIZATION OF TELEOST FISH. *Rev. Can. Biol.* 38(4):281-292. Dec. 1979. In English with French summ. SFA 25(2)
[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523]

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[Inst. Mar. Biochem., St. Fittick's Rd., Aberdeen, Scotland]

80-001017 Kerstens, A.; J. P. Lomholt and K. Johansen. THE VENTILATION, EXTRACTION AND UPTAKE OF OXYGEN IN UNDISTURBED FLOUNDERS, *PLATICHTHYS FLESUS*: RESPONSES TO HYPOXIA ACCLIMATION. *J. Exp. Biol.* 83:169-179. Dec. 1979. SFA 25(2)
[Dep. Zoophysiol., Univ. Aarhus, DK-8000 Aarhus C., Denmark]

80-001018 Kilambi, R. V. and A. Zdinak. THE EFFECTS OF ACCLIMATION ON THE SALINITY TOLERANCE OF GRASS CARP, *CTENOPHARYNGODON IDELLA* (CUV. AND VAL.). *J. Fish Biol.* 16(2):171-175. Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Ark., Fayetteville 72701] Grass carp acclimated to 3, 5, 7, and 9°/oo salinities were tested for salinity tolerance. The upper tolerance limit (LS_{50}) for 3 and 5°/oo, and 7°/oo acclimated fish were 14.2 and 14.0°/oo, respectively. Fish acclimated to 9°/oo had a 50% mortality at an estimated salinity of 16.0°/oo, for 24 h exposure. Weight losses for the 3 and 5°/oo acclimated fish were significantly lower than for those acclimated to 9°/oo.

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[Div. Mar. Radioecol., Natl. Inst. Radioecol. Sci., 3609, Isozaki, Nakaminato, Ibaraki 311-12, Japan] The accumulation and excretion of ^{60}Co taken up from seawater were observed using marine fishes to examine the radioactive pollution of marine organisms. Blood, internal medium was a good reserving pool of the nuclide in the fishes and it accumulated more than 15% of the radioactivity in the whole body of the fishes reared for about 90 days in the uptake experiment. Only liver and kidney showed higher radioactivity per unit weight than blood, in the tissues and organs, and muscle showed the lowest concentration of the nuclide. The biological half-lives in muscle of sea bream, yellowtail and flounder at 15°C were calculated as 38.5, 53.3 and 63.0 days, respectively. The steady state concentration factors of muscle by direct uptake of ^{60}Co from seawater were estimated in the range from 0.3 to 1.5 among the fishes in the experiments.

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[Dep. Food Sci. Technol., Univ. Calif., Davis 95616] Two very different antifreeze proteins have been found in fish from ice-seawater environments, both of which function noncolligatively to lower the freezing temperature but not the melting point. One is a glycoprotein obtained from the polar fish *Trematomus borchgrevinki* and *Boreogadus saida*. The other is a nonglycoprotein obtained from the northern Atlantic Ocean fish *Pseudopleuronectes americanus* (winter flounder). Alanine constitutes approx 2/3 of the total amino acids in both proteins. When the glycoprotein and nonglycoprotein were tested individually or as mixtures, they gave similar performance curves.

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[Dep. Biol. Sci., North Tex. State Univ., Denton 76203]

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[Biol. Stn., St. Andrews, NB E0G 2X0, Canada] A number of physiological and behavioral changes comprise the parr-smolt transformation which preadapts certain salmonids, while still in fresh water, for life in the sea. The physiological processes showing notable changes during smoltification are: body coloring, salinity tolerance and hypoosmotic regulation, growth rate and resulting condition factor, lipid and moisture contents, metabolic rate, carbohydrate metabolism, pituitary and thyroid activity, gill ATPase activity and buoyancy regulation. The behavioral changes are in salinity preference, spontaneous activity, territoriality, schooling, and migratory activity. These criteria of smolt status are described in relation to environmental factors which initiate the physiological and behavioral changes. Photoperiod has been identified as the priming factor which coordinates the various changes on a temporal basis. Temperature acts as a controlling factor determining the rates of change and finally as a releasing factor triggering migration.

80-001069 Schreibman, M. P. and L. R. Halpern. THE DEMONSTRATION OF NEUROPHYSIN AND ARGININE VASOTOCIN BY IMMUNOCYTOCHEMICAL METHODS IN THE BRAIN AND PITUITARY GLAND OF THE PLATYFISH, *XIPHOPHORUS MACULATUS*. *Gen. Comp. Endocrinol.* 40(1):1-7. Jan. 1980. SFA 25(2)
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[Zool. Inst., Lehrstuhl Zoophysiol. Univ. Kiel, D-2300 Kiel, West Germany] Heart rate-temperature relationships were determined on unanaesthetized, unrestrained eels acclimated to 15°C and 25°C. Heart rate in eels with intact vagal tonus exhibited a nearly complete temperature compensation. The degree of compensation was considerably reduced by blocking the vagus function with benzetimide. The difference in the sensitivity of heart rate to temperature change induced by temperature acclimation was significantly decreased after benzetimide-treatment. The inhibitory vagal tonus was significantly higher in warm-acclimated than in cold-acclimated eels. It is concluded that adaptation of heart rate to temperature is mediated by the parasympathetic system to a great extent.

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[Zool. Dep., Univ. Coll. Swansea, Singleton Park, Swansea, U.K.]

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[Inst. Biol. South. Seas, Ukrainian SSR Acad. Sci., Sevastopol, USSR]

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[Dep. Zool., Univ. Me., Orono 04469]

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[Dep. Zool., Gorakhpur Univ., Gorakhpur - 273 001, India]

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[A.E.V. Haschemeyer: Dep. Biol. Sci., Hunter Coll. City Univ. N.Y., Box 741, New York 10021]

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[Inst. Fish. Biol., Univ. Bergen, Nordnesparken 29, 5011 Bergen-Nordnes, Norway]

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80-001078 Spanovskaya, V. D. and V. V. Roldugina. SOME BLOOD INCATORS IN THE ROACH, *RUTILUS RUTILUS*, FROM MOZHAYSK RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):960-967. 1978. SFA 25(2)
[Dep. Ichthyol., Moscow Univ., USSR] In sexually mature males of the roach, *Rutilus rutilus*, from Mozhaysk reservoir the concentration of hemoglobin and number of erythrocytes are higher than in the females, and the value of these indicators decreases as the fish age. The number of leukocytes and the range of variability of this indicator are greater in females than in males. In the course of the summer the highest indicators of hemoglobin content were observed in May and August, and of number of leukocytes in May and July.

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[Cent. Adv. Stud. Mar. Biol,. Annamalai Univ., Parangipettai 608 502, India] The snake eel *Pisoodonophis boro* (Family Ophichthidae) burrows, causing leaks in the bunds and damaging the salterns and paddy fields adjoining estuaries. The animal's capability to withstand brine in salterns and fresh water in paddy fields was determined from laboratory experiments. The eel tolerated salinities ranging from deionized water to 75°/oo. Adaptation to fresh water as well as full strength seawater was completed within 24 h. The concentration of sodium and chloride in the blood varied by 10-20% on transfer from seawater to fresh water. *P. boro* can survive in paddy fields but not in salterns. However, their occurrence in both is described as a rare phenomenon and not obligatory.

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[Dep. Fish., Fac. Agric., Kyoto Univ., Kyoto 606, Japan]

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[Div. Mar. Radioecol., Natl. Inst. Radioecol. Sci., 3609, Isozaki, Nakaminato, Ibaraki 311-12, Japan]

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[Lab. Fresh-Water Fish-Cult., Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

80-001088 Takashima, Y.; K. Takano and A. Hara. [CHANGES IN FEMALE-SPECIFIC SERUM PROTEINS DURING THE COURSE OF INDUCED MATURATION OF FEMALE JAPANESE EELS (*ANGUILLA JAPONICA*)]. *Bull. Fac. Fish. Hokkaido Univ.* 30(1):50-61. Feb. 1979. In Japanese with English summ. SFA 25(2)
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80-001093 Tomasso, J. R.; K. B. Davis and N. C. Parker. PLASMA CORTICOSTEROID AND ELECTROLYTE DYNAMICS OF HYBRID STRIPED BASS (WHITE BASS X STRIPED BASS) DURING NETTING AND HAULING STRESS. *J. Tenn. Acad. Sci.* 55(2):54. Apr. 1980. Abstract only. SFA 25(2)

[Memphis State Univ., Memphis, TN] Netting and hauling-induced stress was evaluated in reciprocal striped bass hybrids (*Morone chrysops* female x *Morone saxatilis* male) using changes in plasma corticosteroid levels as a general indicator of stress and changes in plasma chloride levels as an indicator of osmoregulatory dysfunction. Fish confined in a net for 10 minutes exhibited significantly elevated corticosteroid levels (24.2±5.4 µl/100 ml) and slight hyperchloremia (150.0±2.7 meq/liter) when compared to baseline levels (0.8±0.1 µg/100 ml and 132.6 ± 1.5 meq/liter, respectively). Hauling hybrid striped bass for 2 hours in fresh water significantly elevated corticosteroid levels (12.2 ± 1.2 µg/100 ml) and reduced chloride levels (119.8 ± 1.4 meq/liter). Corticosteroid levels remained high and hypochloremia developed within 24 hours of both netting and hauling. Netting and hauling in 25 mg/liter MS-222 or 10 g/liter NaCl prevented chloride depletion during the stress, but hypochloremia developed within 72 hours of recovery in fresh water. Hauling in a combination of MS-222 and NaCl prevented hypochloremia for up to 72 hours after hauling; plasma corticosteroids, elevated during the haul, returned to near baseline levels within 24 hours. The development of hypochloremia several hours after handling indicates that, although hybrid bass survive the initial stress, survival may be reduced in the days following handling. A combination of 25 mg/liter MS-222 and 10 g/liter salt was the most successful handling medium tested.

80-001094 van Bohemen, Ch. G. and J. G. D. Lambert. INDUCTION AND ANNUAL PLASMA LEVELS OF YOLK PROTEINS IN *SALMO GAIRDNERI*. *Gen. Comp. Endocrinol.* 40(3):319. Mar. 1980. Abstract only. SFA 25(2)

[Zool. Lab., Padualaan 8, Utrecht, The Netherlands]

80-001095 Van Den Hurk, R.; G. A. Slof and F. A. Schurer. GONADAL SEX DIFFERENTIATION IN RAINBOW TROUT, *SALMO GAIRDNERI* WITH SPECIAL REFERENCE TO THE EFFECTS OF STEROID HORMONES AND N,N-DIMETHYLFORMAMIDE. *Gen. Comp. Endocrinol.* 40(3):323. Mar. 1980. Abstract only. SFA 25(2)

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[Dep. Biol., Med. Fac., Univ. Nijmegen, Nijmegen, The Netherlands]

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[Dep. Zool., Univ. Lund, Lund, Sweden]

80-001098 Vislie, T. CELL VOLUME REGULATION IN ISOLATED, PERFUSED HEART VENTRICLE OF THE FLOUNDER (*PLATICHTHYS FLESUS*). *Comp. Biochem. Physiol. A Comp. Physiol.* 65(1):19-27. 1980. SFA 25(2)

[Zool. Inst., Univ. Oslo, Box 1050, Blindern, Oslo 3, Norway]

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[Lab. Mar. Biochem., Fac. Agric., Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan]

80-001100 Watson, D. and J. Bastian. FREQUENCY RESPONSE CHARACTERISTICS OF ELECTRORECEPTORS IN THE WEAKLY ELECTRIC FISH, *GYMNOTUS CARAPO*. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 134(3):191-202. 1979. SFA 25(2)
[Sect. Neurobiol. Behav., Cornell Univ., Ithaca, NY 14853]

80-001101 Weihs, D. ENERGETIC SIGNIFICANCE OF CHANGES IN SWIMMING MODES DURING GROWTH OF LARVAL ANCHOVY, *ENGRAULIS MORDAX*. *NOAA Fish. Bull.* 77(3):597-604. July 1979. SFA 25(2)
[Dep. Aeronaut. Eng., Technion, Haifa, Israel] The swimming behavior of larval northern anchovy, *Engraulis mordax*, in the first few days after hatching is different from the intermittent beat-and-glide mode used by older larvae and later stage fish. It is shown mathematically that the bursts of continuous swimming typical of these yolk-sac larvae is the more efficient form of locomotion at this stage, because of their small size. This advantage changes as the larva grows out of the size range in which water viscosity is the dominant factor (small Reynolds number). When the larva reaches a length of 5 mm, typical Reynolds numbers are such that intermittent swimming gradually becomes the more economical mode, and this mode is dominant when the larvae reach 15 mm. These analytical results compare well with observed behavioral changes.

80-001102 Wendelaar Bonga, S. E. and J. C. A. Van Der Meij. THE ROLE OF ENVIRONMENTAL CALCIUM IN THE CONTROL OF PROLACTIN SECRETION IN THE TELEOST *SAROTHERODON MOSSAMBICUS (TIPAPIA MOSSAMBICA)*. *Gen. Comp. Endocrinol.* 40(3):342. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Univ. Nijmegen, Nijmegen, The Netherlands]

80-001103 Wendelaar Bonga, S. E. EFFECT OF SYNTHETIC SALMON CALCITONIN AND LOW AMBIENT CALCIUM ON PLASMA CALCIUM, ULTIMOBRANCHIAL CELLS, STANNIUS BODIES, AND PROLACTIN CELLS IN THE TELEOST *Gasterosteus aculeatus*. *Gen. Comp. Endocrinol.* 40(1):99-108. Jan. 1980. SFA 25(2)
[Univ. Nijmegen, Dep. Zool., Nijmegen, The Netherlands]

80-001104 Whitehead, C.; N. R. Bromage; R. Harbin and A. J. Matty. OESTRADIOL-17β, CALCIUM, AND VITELLOGENIN INTERRELATIONSHIPS DURING ACCELERATED AND BIANNUAL SPAWNINGS IN THE RAINBOW TROUT. *Gen. Comp. Endocrinol.* 40(3):329-330. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Biol. Sci., Univ. Aston, Birmingham B4 7ET, England]

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[Dep. Biol., McMaster Univ., 1280 Main St. West, Hamilton, ON L8S 4K1, Canada]

80-001106 Wright, G. M. THE ENDOSTYLE, THYROID, AND METAMORPHOSIS IN THE ANADROMOUS SEA LAMPREY, *PETROMYZON MARINUS* L. *Ph.D. dissertation, Univ. Toronto (Canada)* 1979. From Diss. Abstr. Int. B Sci. Eng. 40(8):3623. Feb. 1980. SFA 25(2)

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80-001107 Yakovleva, I. V. and N. A. Yefimova. COMPARATIVE DETERMINATION OF THYROTROPIC HORMONE IN THE PITUITARY OF *ACIPENSER GULDENSTADTI* LARVAE AND FINGERLINGS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):807-815. 1978. SFA 25(2)
[I. M. Sechenov Inst. Evol. Physiol. Biochem., USSR Acad. Sci., Leningrad, USSR]

80-001108 Yamaguchi, K.; N. Takeda; K. Ogawa and K. Hashimoto. [PROPERTIES OF MACKEREL AND SARDINE MYOGLOBINS]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1335-1339. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Mar. Biochem., Fac. Agric., Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan]

80-001109 Yamamoto, K.; Y. Itazawa and H. Kobayashi. SUPPLY OF ERYTHROCYTES INTO THE CIRCULATING BLOOD FROM THE SPLEEN OF EXERCISED FISH. *Comp. Biochem. Physiol. A Comp. Physiol.* 65(1):5-11. 1980. SFA 25(2)
[Ono Limnol. Stn., Shimonoseki Univ. Fish., Ono, Ube, 754-13, Japan] Hematocrit and hemoglobin concentrations of yellowtail blood elevated more than 40% just after a severe exercise by 5 min chasing. About 40% of the hematocrit elevation is considered to have been caused by erythrocyte supply from the spleen, and other 35% by blood condensation due to water shift out of the plasma. Similar phenomena were observed in a cruising experiment.

80-001110 Yaron, Z. and Z. Ilan. STIMULATION OF CORTISOL SECRETION FROM SUPERFUSED INTERRENAL TISSUE OF *TILAPIA AUREA* BY ACTH OR DB cAMP. *Gen. Comp. Endocrinol.* 40(3):349. Mar. 1980. Abstract only. SFA 25(2)
[Zool. Dep., Tel-Aviv Univ., Tel-Aviv, Israel]

80-001111 Yarzhombek, A. A. and V. I. Rozhdestvenskaya. FATIGUE AND ELECTRICALLY INDUCED FATIGUE IN FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):832-838. 1978. SFA 25(2)
[VNIRO, Moscow, USSR] A study was made of the fatigue of the motor system of fishes on natural stimulation of motor activity (frightening, optomotor reaction) and on electrical stimulation of muscular contractions. The reduction in the efficiency of the muscles following electrical stimulation is not identical to the process of natural fatigue. Nevertheless, research involving electrical stimulation can give some idea of the relative efficiency of the muscles.

80-001112 Yorke, M. A. and D. B. McMillan. NATURE AND CELLULAR ORIGIN OF THE ADHESIVE COATS OF THE LAMPREY EGG *(PETROMYZON MARINUS)*. *J. Morphol.* 162(3):313-326. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. West. Ontario, London, ON N6A 5B7, Canada]

80-001113 Yoshikawa, H. and M. Oguri. GONADAL SEX DIFFERENTIATION IN THE MEDAKA, *ORYZIAS LATIPES*, WITH SPECIAL REGARD TO THE GRADIENT OF THE DIFFERENTIATION OF TESTES. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1115-1121. Sept. 1979. SFA 25(2)
[Fish. Lab., Fac. Agric., Nagoya Univ., Furo-cho, Nagoya 464, Japan]

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[Dep. Zool., Univ. Sheffield, Sheffield, England]

80-001115 Young, J. Z. NERVOUS CONTROL OF STOMACH MOVEMENTS IN DOGFISHES AND RAYS. *J. Mar. Biol. Assoc. UK* 60(1):1-17. Feb. 1980. SFA 25(2)
[Wellcome Inst. Hist. Med., 183 Euston Rd., London, England]

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80-001117 Yu, J. Y.-L.; W. W. Dickhoff; Y. Inui and A. Gorbman. SEXUAL PATTERNS OF PROTEIN METABOLISM IN LIVER AND PLASMA OF HAGFISH, *EPTATRETUS STOUTI* WITH SPECIAL REFERENCE TO VITELLOGENESIS. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(1):111-117. 1980. SFA 25(2)
[Dep. Zool., Univ. Wash., Seattle 98195]

80-001118 Zohar, Y. and H. Gordin. SPAWNING KINETICS IN THE GILTHEAD SEA-BREAM, *SPARUS AURATA* L. AFTER LOW DOSES OF HUMAN CHRONIC GONADOTROPIN. *J. Fish Biol.* 15(6):665-670. Dec. 1979. SFA 25(2)
[Lab. Physiol. Poissons, I.N.R.A., 7835 Jouy en Josas, France] This paper reports the temporal pattern of hormonally induced spawning in *Sparus aurata* females reared in captivity. A low dose of human chorionic gonadotropin (100-400 i.u./kg body weight), administered to females with oocytes in the last stages of vitellogenesis, induced a daily cycle of maturation, ovulation and spawning of fertilizable eggs. This cycle pattern lasted for a period of 4-100 days. In fish injected with saline and most of the untreated fish, all vitellogenetic eggs underwent rapid atresia.

80-001119 Zwingelstein, G.; J. Portoukalian; G. Rebel and G. Brichon. GILL SULFOLIPID SYNTHESIS AND SEAWATER ADAPTATION IN EURYHALIN FISH, *ANGUILLA ANGUILLA*. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(3):555-558. 1980. SFA 25(2)
[CNRS, Lab. Physiol. Gen. Comp., Univ. Claude Bernard, Lyon I, 69622 Villeurbonne, France]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001120 Ayling, A. M. HYBRIDIZATION IN THE GENUS *PSEUDOLABRUS* (LABRIDAE). *Copeia* 1980(1):176-180. 1 Feb. 1980. SFA 25(2)
[Mar. Res. Found., Box 2047, Cairns, Queensland, 4870, Australia]

80-001121 Bailey, J. K. and R. L. Saunders. PRELIMINARY REPORT ON RELEASES AND RETURNS OF TWO YEAR-CLASSES OF ATLANTIC SALMON SMOLTS FROM VARIOUS PURE STRAINS AND STRAIN CROSSES. *N. Am. Salmon Res. Cent. Rep.* No. 5. 6p. 1979. SFA 25(2)
[Huntsman Mar. Lab., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Three different river strains of 1974 year-class Atlantic salmon, released as small

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80-001121 CONTINUED (mean=14.1 cm) one-year smolts in 1976 produced about two times more two sea winter adults returns than grilse. The grilse from this release averaged 55.0 cm fork length. The same three strains plus all six possible hybrid combinations planted in 1977 as large (>20 cm) two-year smolts returned a much higher proportion of grilse. The mean length of the grilse returns was 59.6 cm. Four river strains and all 12 hybrid combinations of 1975 year-class salmon released as large (>18 cm) one-year smolts in 1977 returned few medium sized (mean=56.6 cm) grilse. Smolt age, size, and genetic origin appears to influence the size of returning grilse and the grilse-larger salmon ratio.

80-001122 Berrebi, P. and J. Britton-Davidian. ENZYMATIC SURVEY OF FOUR POPULATIONS OF *ATHERINA BOYERI* BASED ON ELECTROPHORESIS AND THE OCCURRENCE OF A MICROSPORIDIOSIS. *J. Fish Biol.* 16(2):149-157. Feb. 1980. SFA 25(2)
[Lab. Ichthyol. Parasitol. Gen., Univ. Montpellier II, Place Eugène Bataillon 34060 Montpellier, France]

80-001123 Blanc, J. M.; B. Chevassus and P. Bergot. DÉTERMINISME GÉNÉTIQUE DU NOMBRE DE CÆCA PYLORIQUES CHEZ LA TRUITE FARIO (*SALMO TRUTTA*, LINNÉ) ET LA TRUITE ARC-EN-CIEL (*SALMO GAIRDNERI*, RICHARDSON). III.--EFFET DU GÉNOTYPE ET DE LA TAILLE DES OEUFS SUR LA RÉALIZATION DU CARACTÈRE CHEZ LA TRUITE FARIO. [GENETIC DETERMINISM OF THE NUMBER OF PYLORIC CAECA IN BROWN TROUT (*SALMO TRUTTA*) AND RAINBOW TROUT (*SALMO GAIRDNERI*). III--INFLUENCE OF THE GENOTYPE AND EGG SIZE ON THE REALIZATION OF THE CHARACTER IN BROWN TROUT.] *Ann. Genet. Sel. Anim.* 11(1):93-103. 1979. In French with English summ. SFA 25(2)
[Lab. Ecol. Poissons, Cent. Rech. Hydrobiol., I.N.R.A., Saint-Pée-sur-Nivelle, 64310 Ascain, France]

80-001124 Chevassus, B.; J. M. Blanc and P. Bergot. DÉTERMINISME GÉNÉTIQUE DU NOMBRE DE CÆCA PYLORIQUES CHEZ LA TRUITE FAERIO (*SALMO TRUTTA*, LINNÉ) ET LA TRUITE ARC-EN-CIEL (*SALMO GAIRDNERI*, RICHARDSON). II.--EFFET DU GÉNOTYPE DU MILIEU D'ELEVAGE ET DE L'ALIMENTATION SUR LA RÉALISATION DU CARACTÉRE CHEZ LA TRUITE ARC-EN-CIEL. [GENETIC ANALYSIS OF THE NUMBER OF PYLORIC CAECA IN BROWN TROUT (*SALMO TRUTTA*, LINNÉ) AND RAINBOW TROUT (*SALMO GAIRDNERI*, RICHARDSON). II--EFFECT OF THE GENOTYPE, REARING ENVIRONMENT AND FEEDING ON THE REALIZATION OF THE CHARACTER IN RAINBOW TROUT.] *Ann. Genet. Sel. Anim.* 11(1):79-92. 1979. In French with English summ. SFA 25(2)
[Lab. Physiol. Poissons, Cent. Natl. Rech. Zootech., I.N.R.A., 78350 Jouy-en-Josas, France]

80-001125 Chilcote, M. W.; B. A. Crawford and S. A. Leider. A GENETIC COMPARISON OF SYMPATRIC POPULATIONS OF SUMMER AND WINTER STEELHEADS. *Trans. Am. Fish. Soc.* 109(2):203-206. Mar. 1980. SFA 25(2)
[Wash. Dep. Game, 600 N. Capitol Way, Olympia 98504]

80-001126 Cokendolpher, J. C. HYBRIDIZATION EXPERIMENTS WITH THE GENUS *CYPRINODON* (TELEOSTEI: CYPRINODONTIDAE). *Copeia* 1980(1):173-176. 1 Feb. 1980. SFA 25(2)
[Mus. Biol. Sci., Tex. Tech Univ., Lubbock 79409]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001127 Felley, J. ANALYSIS OF MORPHOLOGY AND ASYMMETRY IN BLUEGILL SUNFISH (*LEPOMIS MACROCHIRUS*) IN THE SOUTHEASTERN UNITED STATES. *Copeia* 1980(1):18-29. 1 Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Okla., Norman 73019]

80-001128 Felley, J. D. and J. C. Avise. GENETIC AND MORPHOLOGICAL VARIATION OF BLUEGILL POPULATIONS IN FLORIDA LAKES. *Trans. Am. Fish. Soc.* 109(1):108-115. Jan. 1980. SFA 25(2)
[Dep. Zool., Univ. Okla., Norman 73019]

80-001129 Friars, G. W.; J. K. Bailey and R. L. Saunders. CONSIDERATIONS OF A METHOD OF ANALYZING DIALLEL CROSSES OF ATLANTIC SALMON. *Can. J. Genet. Cytol.* 21:121-128. 1979. In English with French summ. SFA 25(2)
[Dep. Anim. Poultry Sci., Univ. Guelph, Guelph, ON, Canada] Inferences derived from a proposed mixed model analysis of a diallel cross involving four stocks of Atlantic salmon (*Salmo salar*) are illustrated with growth data on weight and length. Variation between stocks was more apparent when samples represented dams as opposed to sires, thus stressing the relative importance of maternal effects. However, the ranking of stocks was not altered when either the means of sire sources or the means of dam sources were considered. No heterotic effects were found for the growth traits studied.

80-001130 Fujio, Y. and Y. Kato. GENETIC VARIATION IN FISH POPULATIONS. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1169-1178. Sept. 1979. SFA 25(2)
[Dep. Fish. Sci., Fac. Agric., Tohaku Univ., Sendai 980, Japan]

80-001131 Gold, J. R.; W. J. Karel and M. R. Strand. CHROMOSOME FORMULAE OF NORTH AMERICAN FISHES. *Prog. Fish-Cult.* 42(1):10-23. Jan. 1980. SFA 25(2)
[Genet. Sect., Tex. A&M Univ., College Station 77843]

80-001132 Hirshfield, M. F.; C. R. Feldmeth and D. L. Soltz. GENETIC DIFFERENCES IN PHYSIOLOGICAL TOLERANCES OF AMARGOSA PUPFISH (*CYPRINODON NEVADENSIS*) POPULATIONS. *Science* 207(4434):999-1001. 29 Feb. 1980. SFA 25(2)
[Acad. Nat. Sci. Phila., Benedict Estuarine Res. Lab., Benedict, MD 20612] Amargosa pupfish from a constant-temperature spring have a narrower range of temperature and oxygen tolerances than pupfish from the much more variable Amargosa River, indicating that the two populations have diverged genetically since their isolation. The reduced tolerances of the fish inhabiting a constant environment support the predictions of evolution theory.

80-001133 Holder, V. P. and C. J. Biggers. INVESTIGATION OF IMPROVEMENT IN ELECTROPHORETIC SEPARATION OF PLASMA ALBUMIN OF THE CHANNEL CATFISH, *ICTALURUS PUNCTATUS*. *J. Tenn. Acad. Sci.* 55(2):57-58. Apr. 1980. Abstract only. SFA 25(2)
[Memphis State Univ., Memphis, TN]

80-001134 Hudson, R. G.; G. B. Pardue and J. F. Roberts. ICTALURID CHROMOSOME PREPARATION BY CELL CULTURE AND SQUASH METHODS. *Prog. Fish-Cult.* 42(1):43-45. Jan. 1980. SFA 25(1)
[Dep. Biol., Presbyterian Coll., Clinton, SC 29325]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001135 Khula-Bukhsh, A. R. A HIGH NUMBER OF CHROMOSOMES IN THE HILLSTREAM CYPRINID, *TOR PUTITORA* (PISCES). *Experientia (Basel)* 36(2):173-174. 15 Feb. 1980. SFA 25(2)

[Dep. Zool., Univ. Kalyani, Kalyani-741235, India] The karyotype of a cyprinid fish occurring in India, *Tor putitora*, is described. The diploid complement comprises 100 chromosomes. The modal number in this family being 2n=50, *T. putitora* appears to be another case of tetraploidy.

80-001136 Kormilin, V. V.; R. M. Tsoy; Zh. G. Sarsembayev and N. Ch. Artygaliyev. THE EFFECT OF CHEMICAL MUTAGENS ON SPERMATOZOA OF THE SILVER CARP, *HYPOPHTHALMICHTHYS MOLITRIX*, AND THE BIGHEAD, *ARISTICHTHYS NOBILIS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1030-1033. 1978. SFA 25(2)

[KazNIIRKh, Alma-Ata, USSR] Processing with chemical mutagens of ripe spermatozoa from the silver carp and bighead does not influence the process of fertilization of the eggs negatively. More than that, NEU, NMB and DMS have a stimulating effect expressed in the silver carp in a higher percentage of fertilization. As a result of fertilization of a normal egg of the bighead with spermatozoa treated by chemical mutagens, a sharp increase in the number of aberrant forms is observed among the developed embryos. The number of abnormal embryos is in direct relation to the concentration of mutagens. Ripe spermatozoa from the silver carp proved more resistant to mutagenic action that those of the bighead.--Concl.

80-001137 Leibel, W. S. THE ESTERASE DILEMMA: A COMPARATIVE BIOCHEMISTRY OF FISH ESTERASES. *Ph. D. dissertation, Yale Univ.* 299p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2490. Dec. 1979. SFA 25(2)

80-001138 Márián, T. and Z. Krasznai. COMPARATIVE KARYOLOGICAL STUDIES ON CHINESE CARPS. *Aquaculture* 18(4):325-336. Dec. 1979. SFA 25(2)

[Fish Cult. Res. Inst., Genet. Breed. Dep., P.O. Box 47, H-5541 Szarvas, Hungary]

80-001139 Mitchell, C. P. and D. Scott. MUSCLE MYOGENS IN THE NEW ZEALAND GALAXIIDAE. *N.Z. J. Mar. Freshwater Res.* 13(2):285-294. 1979. SFA 25(2)

[Fish. Res. Div., Minist. Agric. Fish., Nyapuna, Rotorua, New Zealand]

80-001140 Moore, F. D. and A. M. White. LACTATE DEHYDROGENASE ISOZYME PATTERN OF NATURAL LONGNOSE DACE X BLACKNOSE DACE HYBRIDS. *Ohio J. Sci.* 80:14. 1980. Abstract only. SFA 25(2)

[Dep. Biol., John Carroll Univ., Cleveland, OH 44118] During a study of enzyme polymorphism in Chagrin River populations of Longnose Dace (*Rhinichthys cataractae*) we observed an exceptional pattern of cytosolic lactate dehydrogenase (LDH) in nine specimens of the 179 examined. Although the specimens possessing the exceptional pattern exhibited Longnose Dace coloration, pigmentation and general body form, morphometric examination revealed that the lateral line scale counts were low, (range 57-63) and that the eye diameter to snout length ratio was consistantly less than 1.8. Scale counts for the remainder of the population (n=107) were 69.3 ± 4.2 and the eye to snout ratio was 2.37 ± 0.21. These data suggested that the specimens might be hybrids with another species, thus we conducted an electrophoretic investigation to determine other possible parental species. Of all other species examined, only the Blacknose Dace (*Rhinichthys atratulus*) possessed LDH isozymes with the appropriate mobility. Mixtures of liver extracts from both dace produced a pattern indistinguishable from the exceptional pattern. We feel that the combination of the mixed LDH isozyme pattern and the intermediate morphometric characters indicate that these specimens represent naturally occuring hybrids of these two similar species.

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001141 Morizot, D. C. and M. J. Siciliano. POLYMORPHISMS, LINKAGE AND MAPPING OF FOUR ENZYME LOCI IN THE FISH GENUS *XIPHOPHORUS* (POECILIIDAE). *Genetics* 93(4):947-960. Dec. 1979. SFA 25(2)
[Univ. Tex. Grad. Sch. Biomed. Sci., Houston 77030]

80-001142 Ojima, Y. and A. Takai. FURTHER CYTOGENETICAL STUDIES ON THE ORIGIN OF THE GOLD-FISH. *Proc. Jpn. Acad. B. Phys. Biol. Sci.* 55(7):346-350. Sept. 1979. SFA 25(2)
[Dep. Biol., Fac. Sci., Kwansei Gakuin Univ., Nishinomiya, Japan]

80-001143 Ojima, Y. and E. Kashiwagi. A KARYOTYPE STUDY OF ELEVEN SPECIES OF LABRID FISHES FROM JAPAN. *Proc. Jpn. Acad. Ser. B Phys. Biol. Sci.* 45(6):280-285. June 1979. SFA 25(2)
[Dep. Biol., Fac. Sci., Kwansei Gakuin Univ., Nishinomiya, Japan]

80-001144 Payusova, A. N. ELECTROPHORETIC ANALYSIS OF THE BLOOD SERUM OF TWO SPECIES OF ISSYK-KUL DACE - *LEUCISCUS SCHMIDTI* AND *L. BERGI*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):800-806. 1978. SFA 25(2)
[Biol. Fac., Moscow Univ., USSR] Electrophoresis in polyacrylamide gel was used to investigate the protein spectrum of the blood serum of two Issyk-Kul dace species (*Leuciscus*). Individual variability was discovered in the spectra connected with sex and the maturity stage of the gonads, and also with polymorphism of transferrin. The two closely related species have identical blood serum spectra.

80-001145 Philipp, D. P.; W. F. Childers and G. S. Whitt. EVOLUTION OF PATTERNS OF DIFFERENTIAL GENE EXPRESSION: A COMPARISON OF THE TEMPORAL AND SPATIAL PATTERNS OF ISOZYME LOCUS EXPRESSION IN TWO CLOSELY RELATED FISH SPECIES (NORTHERN LARGEMOUTH BASS, *MICROPTERUS SALMOIDES SALMOIDES*, AND SMALLMOUTH BASS, *MICROPTERUS DOLOMIEUI*). *J. Exp. Zool.* 210(3):473-488. Dec. 1979. SFA 25(2)
[Dep. Genet. Dev., Univ. Ill., Urbana]

80-001146 Pontier, P. J. GENETIC CONTROL OF ISOZYME EXPRESSION DURING THE DEVELOPMENT OF TWO TELEOSTS, *BRACHYDANIO RERIO* AND *BRACHYDANIO ALBOLINEATUS*. *Ph.D. dissertation, Rutgers Univ.* 209p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(7):3045. Jan. 1980. SFA 25(2)

80-001147 Riddell, B. E. ENVIRONMENTAL AND GENETIC SOURCES OF GEOGRAPHIC VARIATION IN POPULATIONS OF ATLANTIC SALMON, *SALMO SALAR* LINNAEUS. *Ph.D. dissertation, McGill Univ. (Canada)* 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4104. Mar. 1980. SFA 25(2)

80-001148 Serra, V. and R. Mandarino. SHORT PERIOD INTERSPERSION PATTERN IN THE GENOME OF A TELEOSTEAN FISH. *J. Exp. Zool.* 210(3):515-520. Dec. 1979. SFA 25(2)
[Dep. Biol. Cell., Univ. Calabria, 87030 Arcavacata di Rende (CS), Italy]

80-001149 Sidell, B. D. and K. F. Beland. LACTATE DEHYDROGENASES OF ATLANTIC HAGFISH: PHYSIOLOGICAL AND EVOLUTIONARY IMPLICATIONS OF A PRIMITIVE HEART ISOZYME. *Science* 207(4432):769-770. 15 Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Me., Orono 04469] Isozymes of lactate dehydrogenase from heart and muscle of Atlantic hagfish show less functional divergence than those from other fishes and higher vertebrates. The enzyme from hagfish heart

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80-001149 CONTINUED (B_4) displays a higher Michaelis constant for pyruvate and lower substrate inhibition at moderate pyruvate concentrations than heart isozymes from other species. These properties support the hypothesis that the ancestral vertebrate lactate dehydrogenase was a muscle (A_4)-type enzyme and also suggest a role for the B_4 enzyme in the unusual physiology of hagfish cardiac tissue which functions under sustained hypoxic conditions.

80-001150 Sidell, B. D.; R. G. Otto; D. A. Powers; M. Karweit and J. Smith. APPARENT GENETIC HOMOGENEITY OF SPAWNING STRIPED BASS IN THE UPPER CHESAPEAKE BAY. *Trans. Am. Fish. Soc.* 109(1):99-107. Jan. 1980. SFA 25(2)
[Dep. Zool., Univ. Me., Orono 04469]

80-001151 Smirnov, A. I. THE VARIABILITY OF THE BLACK SEA-AZOV TOAD-GOBY, *MESOGOBIUS BATRACHOCEPHALUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1010-1013. 1978. SFA 25(2)
[Zool. Inst., Ukrainian SSR Acad. Sci., Kiev, USSR]

80-001152 Thorgaard, G. H. and G. A. E. Gall. ADULT TRIPLOIDS IN A RAINBOW TROUT FAMILY. *Genetics* 93(4):961-973. Dec. 1979. SFA 25(2)
[Prog. Genet., Wash. State Univ., Pullman 99164] Six triploid individuals were found in a full-sib family of 11 adult rainbow trout (*Salmo gairdneri*) from a domesticated hatchery stock. The triploid individuals were normal in size and external appearance, had underdeveloped gonads, and showed no evidence of 3n/2n chimerism or mosaicism. *XXY* triploids were males, suggesting that the *Y* chromosome is male determining in trout. Because they may avoid production losses associated with sexual maturation in normal fish, triploid trout and salmon could potentially be useful in fish culture.

80-001153 Ueno, K.; S. Iwai and Y. Ojima. [KARYOTYPES AND GEOGRAPHICAL DISTRIBUTION IN THE GENUS *COBITIS* (COBITIDAE).] *Bull. Jpn. Soc. Sci. Fish.* 46(1):9-18. Jan. 1980. In Japanese with English summ. SFA 25(2)
[Dep. Fish., Fac. Agric., Kinki Univ., Higashi-Osaka 557, Japan] Karyotypes of three spinous loaches, *Cobitis biwae*, *C. taenia taenia* and *C. taenia striata* from western Japan were investigated. As the result, chromosome polymorphisms and polyploid (tetraploid) were observed in these species. (1) *C. biwae*: Diploid specimens showed 48 chromosones in 2n number. There were three types in chromosome constitutions such as 22M+20SM, ST+6A, 20M+20SM, ST+8A and 20m+18SM, ST+10A. On the other hand, tetraploid specimens were characterized by 96 chromosones which consisted of 38M+54SM, ST+20A. (2) *C. taenia taenia*: Diploid specimens with 50 chromosomes were characterized by 12M+4SM+34A. In the tetraploid forms, two types of individuals with 86 and 94 chromosome numbers were found. These complements were made up of 32M+32SM, ST+22A in the former, and 26M+32SM, ST+36A in the latter. (3) *C. taenia striata*: Diploid form was the same as that of *C. taenia taenia*, whereas tetraploid form possessed 98 chromosomes consisting of 20M+22SM, ST+56A. (4) The geographical distribution on each group with different karyotypes showed that they have their own habitats forming respective isolated associations. Systematics and speciation in three species of Cobitidae were discussed on the bases of the karyotypic differentiation and habitat segregation.

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

80-001154 Varma, A. K. and J. S. Frankel. A COMPARISON OF TISSUE ESTERASES IN THE GENUS *BARBUS* BY VERTICAL GEL ELECTROPHORESIS. *Comp. Biochem. Physiol. B Comp. Biochem.* 65(2):267-273. 1980. SFA 25(2)
[J. S. Frankel: Dep. Zool., Harvard Univ., Washington, DC 20059]

80-001155 Vladimirov, M. Z. EARLY POSTEMBRYONIC DEVELOPMENT AND MORPHOLOGY OF A NEW INTERGENERIC CYPRINID HYBRID (*RUTILUS FRISII* FEMALE X *VIMBA VIMBA VIMBA* MALE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):859-862. 1978. SFA 25(2)
[Inst. Exp. Zool. Physiol., Moldavian Acad. Sci., Kishinev, USSR]

80-001156 Yelenc, J. G. INVESTIGATION OF CHROMOSOME BANDING TECHNIQUES AND OF PSEUDOLINKAGE IN *SALVELINUS* SPECIES. *Ph.D. dissertation, Pa. State Univ.* 152p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4092. Mar. 1980. SFA 25(2)

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80-001157 Ali, M. A. and G. E. Pickford. THE EFFECTS OF HYPOPHYSECTOMY ON THE RETINOMOTOR RESPONSES OF THE KILLIFISH, *FUNDULUS HETEROCLITUS*. *Rev. Can. Biol.* 38(3):139-144. Sept. 1979. In English with French summ. SFA 25(2)
[Dep. Biol., Univ. Montreal, PQ H3C 3J7, Canada]

80-001158 Anonymous. RARE SHARK ATTACK MARS COASTAL SURFING. *Oreg. Wildl.* 35(1):12-13. Jan. 1980. SFA 25(2)

80-001159 Ashmore, J. F. and G. Falk. THE SINGLE-PHOTON SIGNAL IN ROD BIPOLAR CELLS OF THE DOGFISH RETINA. *J. Physiol. (Lond.)* 300:151-166. Mar. 1980. SFA 25(2)
[Dep. Ophthalmol., Univ. Calif., San Francisco 94143]

80-001160 Ashmore, J. F. and G. Falk. RESPONSES OF ROD BIPOLAR CELLS IN THE DARK-ADAPTED RETINA OF THE DOGFISH, *SCYLIORHINUS CANICULA*. *J. Physiol. (Lond.)* 300:115-150. Mar. 1980. SFA 25(2)
[Dep. Ophthalmol., Univ. Calif., San Francisco 94143]

80-001161 Bols, R. J. and J. A. Hogan. RUNWAY BEHAVIOR OF SIAMESE FIGHTING FISH, *BETTA SPLENDENS*, FOR AGGRESSIVE DISPLAY AND FOOD REINFORCEMENT. *Anim. Learn. Behav.* 7(4):537-542. Nov. 1979. SFA 25(2)
[Univ. Toronto, Toronto, ON M5S 1A1, Canada]

80-001162 Bowmaker, J. K. VISUAL PIGMENT ABSORBANCE AND SCOTOPIC SPECTRAL SENSITIVITY IN THE GOLDFISH, *CARASSIUS AURATUS*. *Rev. Can. Biol.* 38(3):185-187. Sept. 1979. In English with French summ. SFA 25(2)
[Dep. Zool. Comp. Physiol., Queen Mary Coll., Mile End Rd., London E1 4NS, England]

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80-001163 Chauvin-Muckensturm, B. LE PROBLÈME DE LA FIXATION GÉNOTYPIQUE DU COMPORTEMENT AGRESSIF CHEZ LES ÉPINOCHES (*GASTEROSTEUS ACULEATUS* L.). [IS THERE A GENOTYPIC FIXATION OF AGGRESSIVE BEHAVIOUR IN THREE SPINED STICKLEBACK.] *C.R. Hebd. Seances Acad. Sci. Ser. D Sci. Nat.* 289(13):935-938. 19 Nov. 1979. In French with English summ. SFA 25(2)
[Univ. René-Descartes, Lab. Sociol. Anim., Château d'Ivoy-le-Pré, 18380 La-Chapelle-Angillon, France] There is no evidence of a genotype fixation of the raction to red belly models in naive three spined Sticklebacks.

80-001164 Coutant, C. C. and D. S. Carroll. TEMPERATURES OCCUPIED BY TEN ULTRASONIC-TAGGED STRIPED BASS IN FRESHWATER LAKES. *Trans. Am. Fish. Soc.* 109(2):195-202. Mar. 1980. SFA 25(2)
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830]

80-001165 deMond, D. K. BEHAVIORAL THERMOREGULATION OF THE BLUEGILL, *LEPOMIS MACROCHIRUS*. *J. Miss. Acad. Sci.* 24(Suppl.):114. 1979. Abstract only. SFA 25(2)
[Dep. Biol., Univ. South. Miss., Hattiesburg 39401]

80-001166 Eberhart, A. C. THE SOUND PRODUCING MECHANISMS OF THE BROWN BULLHEAD, *ICTALURUS NEBULOSUS*. *M.A. thesis, Calif. State Univ. (Long Beach)* 39p. 1979. From Masters Abstr. 17(4):295. Dec. 1979. SFA 25(2)
The brown bullhead, *Ictalurus nebulosus*, is a catfish that typically inhabits low elevation lakes throughout much of North America. This paper describes the sounds of the brown bullhead and the mechanisms by which these sounds are produced. Grunting sounds with a frequency of 50-400 Hz and a duration of 0.25 s are produced by vibration of the swim bladder. The mechanism of swim bladder vibration involves the posterior rami of the fourth vertebral parapophyses and their associated fast-acting muscles, and is unique to any described previously. Clicking sounds are also produced, which have a duration of 0.1 s at 250 Hz and a shorter duration at frequencies between 250 and 2,500 Hz. The probable mechanism of these clicks involves contact between the more dorsal spine of the cleithrum and the anterior ramus of the fourth vertebral parapophysis (Mullerian ramus).

80-001167 Goodyear, C. P. and D. H. Bennett. SUN COMPASS ORIENTATION OF IMMATURE BLUEGILL. *Trans. Am. Fish. Soc.* 108(6):555-559. Nov. 1979. SFA 25(2)
[U.S. FWS, 2929 Plymouth Rd., Room 206, Ann Arbor, MI 48105]

80-001168 Helfman, G. S. TEMPORAL RELATIONSHIPS IN A FRESHWATER FISH COMMUNITY. *Ph. D. dissertation, Cornell Univ.* 279p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2504. Dec. 1979. SFA 25(2)

80-001169 Hesthagen, I. H. LOCOMOTOR ACTIVITY IN THE PAINTED GOBY, *POMATOSCHISTUS PICTUS* (MALM) (PISCES), IN RELATION TO LIGHT INTENSITY. *Sarsia* 65(1):13-18. 1980. SFA 25(2)
[Inst. Marinbiol. Limnol., Univ. Oslo, P.B. 1064 Blindern, Oslo 3, Norway]

80-001170 Hogan, J. A. and R. J. Bols. PRIMING OF AGGRESSIVE MOTIVATION IN *Betta splendens*. *Anim. Behav. (Baillière Tindall, Publ.)* 28(1):135-142. Feb. 1980. SFA 25(2)
[Dep. Psychol., Univ. Tortoto, Toronto, ON M5S 1A1, Canada] Swimming speed in a runway for a view of a conspecific was shown to be positively correlated with vigour of aggressive display prior to the experiment. A

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80-001170 CONTINUED priming procedure (pre-exposure to a conspecific), and decreasing the time between trials, were then shown to increase swimming speed. Priming also increased the choice for a conspecific over food, but only in the presence of particular external stimuli. These results are interpreted to mean that the level of aggressive motivation is determined by a complex interaction of internal and external factors, and that there is a high degree of similarity between aggression and other motivations such as hunger and thirst.

80-001171 Inoue, M.; T. Arimoto and I. Kono. [DEGREE OF DISPERSION OF THE *ZACO TEMMINCKI* SCHOOL TO WATER QUALITY IN A STREAMING WATER TROUGH.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1485-1490. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Tokyo Univ. Fish., Konan, Minato-ku, Tokyo 108, Japan]

80-001172 Iwasaki, Y. [A STUDY ON THE BODY SIZE COMPOSITION OF YELLOWFIN TUNA AND SKIPJACK SHOALS CAUGHT BY PURSE SEINES.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):19-25. Jan. 1980. In Japanese with English summ. SFA 25(2)
[Fac. Mar. Sci. Technol., Tokai Univ., Shimizu 424, Japan]

80-001173 Kabayama, A.; G. Kawamura and T. Yonemori. THE AXIS OF HORIZONTAL EYE ROTATION OF FISH. *Bull. Jpn. Soc. Sci. Fish.* 45(12):1481-1483. Dec. 1979. SFA 25(2)
[Nippon Oceanic Survey Co. Ltd., Minato 7-8, Moji, Kitakyushu 801, Japan]

80-001174 Kavaliers, M. SOCIAL GROUPINGS AND CIRCADIAN ACTIVITY OF THE KILLIFISH, *FUNDULUS HETEROCLITUS*. *Biol. Bull. (Woods Hole)* 158(1):69-76. Feb. 1980. SFA 25(2)
[Dep. Zool. Entomol., Colo. State Univ., Fort Collins 80523]

80-001175 Kawamura, G. [FUNDAMENTAL STUDY ON APPLICATION OF THE VISION OF SPOTTED MACKEREL, *PNEUMATOPHORUS TAPEINOCEPHALUS* (BLEEKER), TO ANGLING TECHNIQUES--VI. MOVEMENT OF FISH SCHOOL ATTRACTED TO FISH LAMP ESTIMATED FROM THE TIME SERIES OF CATCH]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1241-1247. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Technol., Fac. Fish., Kagoshima Univ., Kagoshima, Japan]

80-001176 Kawamura, G. [FUNDAMENTAL STUDY ON APPLICATION OF THE VISION OF SPOTTED MACKEREL, *PNEUMATOPHORUS TAPEINOCEPHALUS* (BLEEKER), TO ANGLING TECHNIQUES--V. DISCUSSION ON THE LIGHT INTENSITY OF FISH LAMP]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1237-1240. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Technol., Fac. Fish., Kagoshima Univ., Kagoshima, Japan]

80-001177 Kawamura, G. and A. Kabayama. HORIZONTAL COMPENSATORY EYE MOVEMENTS IN SWIMMING FISHES. *Bull. Jpn. Soc. Sci. Fish.* 45(11):1359-1364. Nov. 1979. SFA 25(2)
[Lab. Fish. Technol., Fac. Fish., Kagoshima Univ., Kagoshima, 890 Japan]

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80-001178 Kerr, S. R. and E. E. Werner. NICHE THEORY IN FISHERIES ECOLOGY. *Trans. Am. Fish. Soc.* 109(2):254-260. Mar. 1980. SFA 25(2)
[Dep. Fish. Oceans, Bedford Inst. Oceanogr., P.O. Box 1006, Dartmouth NS B2Y 4A2, Canada]

80-001179 Kingston, D. I. EYE-COLOR CHANGES DURING AGGRESSIVE DISPLAYS IN THE GOODEID FISHES. *Copeia* 1980(1):169-171. 1 Feb. 1980. SFA 25(2)
[Fish Div., Mus. Zool., Univ. Mich., Ann Arbor 48109]

80-001180 Konagaya, T. [JUMPING RESPONSE OF AYU TO SOUND.] *Bull. Jpn. Soc. Sci. Fish.* 46(1):31-34. Jan. 1980. In Japanese with English summ. SFA 25(2)
[Fac. Fish., Mie Univ., Edobashi, Tsu 514, Japan] While ascending streams from the sea to the upper river, the fry of ayu (*plecoglossus altivelis*) has a strong anadromous character and shows jumping response not only to water falls but also to underwater sound. Generally, the auditory sensitivity of fish has been studied with electrophysiological or psychophysical experiments. It may also be possible to study it by the behavioral observation of the jumping response of the fish to underwater sound. From these observations, the following results were obtained: The most sensitive frequency of the fish to underwater sound was about 200 Hz. However, the sensitivity of the fish was not clear above 600 Hz. The lowest threshold level of underwater sound for jumping response was 72 dB (re 1 µPa) at a frequency of 200 Hz. The numbers of fish responding to the sound pressure were distributed following a normal curve in the range of 70 to 80 dB (re 1 µPa).

80-001181 Krassenstein, R. C. HABITAT SELECTIVITY OF TROUT-PERCH LARVAE IN THE CONNEAUT HARBOR AREA OF LAKE ERIE. *Ohio J. Sci.* 80:13. 1980. Abstract only. SFA 25(2)
[Dep. Biol., John Carroll Univ., Cleveland, OH 44118] Larval Trout-perch (*Percopsis omiscomaycus*) were collected by standard replicate ichthyoplankton tows at six sites in and near the Conneaut Harbor between 1 May and 15 August, 1978. Sample sites were chosen to include two "protected" areas immediately inside the breakwalls, two "unprotected" areas immediately outside these walls in Lake Erie, a location in the open-water area of mid-harbor and a beach area just west of the harbor. In all areas the frequency of Trout-perch larval forms increased through the month of May, peaked in mid-June and declined thereafter. Throughout the sampling period, sites offering protection from wave action produced higher numbers of larvae per cubic meter of water than all other sites. Open lake sites near the breakwalls and at the beach yielded moderate numbers of larvae while the site in mid-harbor exhibited the fewest larvae. These data suggest that artificially created areas of protected waters may be an extremely important factor in the production of Trout-perch in the Central Basin of Lake Erie, and further that breakwalls in general may serve as acceptable and perhaps equivalent areas of production when compared to available beach spawning areas.

80-001182 Kratochvil, H. GESCHLECHTSDIMORPHISMUS BEIM LAUTAPPARAT DES KNURRENDEN ZWERGGURAMI *TRICHOPSIS PUMILUS* ARNOLD (ANABANTIDAE, TELEOSTEI). [SEXUAL DIMORPHISM OF THE SOUND PRODUCING ORGAN IN THE PYGMY GOURAMI (*TRICHOPSIS PUMILUS* ARNOLD) (ANABANTIDAE, BELONTIIDAE).] *Zoomorphologie* 94(2):203-208. 1980. In German with English summ. SFA 25(2)
[Zool. Inst. Univ. Vienna, Dr. Karl Leuger-Ring 3, A-1010 Vienna, Austria]

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80-001183 Lapkins, V. V.; A. M. Svirski and Yu. N. Sopov. SELECTED AND ACCLIMATION TEMPERATURES IN FISHES. *Zool. Zh.* 58(11):1659-1670. Nov. 1979. In Russian with English summ. SFA 25(2)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl Dist., USSR]

80-001184 Laughlin, D. R. RESOURCE AND HABITAT USE PATTERNS IN TWO COEXISTING SUNFISH SPECIES (*LEPOMIS GIBBOSUS* AND *LEPOMIS MEGALOTIS PELTASTES*). *Ph.D. dissertation, Mich. State Univ.* 102p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(7):3041. Jan. 1980. SFA 25(2)
Habitat partitioning is the principal means of interspecific coexistence in small soft-bottomed lakes in Michigan. The northern longear and pumpkinseed sunfishes are both morphologically similar and apparently adapted for benthic foraging. Clear spatial segregation was observed in preliminary studies. The sympatric distribution of both species in 5 local lakes was quantified in relation to the structural habitat. Food utilization was examined with respect to prey type, size and microhabitat association. During mid-summer, the larger size-classes of each species used different foraging micro-habitats. Adult longears were specialized for foraging within marl sediments and are absent when this micro-habitat is not present. Their spatial distribution was largely dependent upon the arrangement of sediment micro-habitats within the environment. Pumpkinseeds were generally distributed, but were more closely associated with aquatic vegetation and prey, primarily hardshelled gastropods. Interspecific spatial overlap was negatively related to the degree of separation of foraging micro-habitats. The smaller size-classes exhibited greater food and spatial overlap, a pattern attributable to predation pressure. Greater interspecific food overlap also occurred during the spring. It is concluded that little competition exists at the present time between the longear and pumpkinseed. The longear is a habitat specialist that uses a distinctively different niche than the pumpkinseed. The present niche differences are attributable to the evolutionary environment of each species. A consideration of the sunfish community shows that morphological and behavioral traits are related to the ecological characteristics of the habitat and prey.--From abstr.

80-001185 Luoma, M. E. and J. H. Gee. SEASONAL FACTORS AFFECTING BUOYANCY ATTAINED IN STILL WATER AND CURRENT BY FATHEAD MINNOWS, *PIMEPHALES PROMELAS*. *Can. J. Fish. Aquatic Sci.* 37(4):670-678. Apr. 1980. SFA 25(2)
[Dep. Zool., Univ. Manitoba, Winnipeg, MB R3T 2N2, Canada]

80-001186 Madsen, L. SOCIAL SPACING IN NORTHERN GULF KILLIFISHES. *Proc. La. Acad. Sci.* 42:82. 1979. Abstract only. SFA 25(2)
[La. State Univ., Baton Rouge]

80-001187 Mathur, D. and C. A. Silver. STATISTICAL PROBLEMS IN STUDIES OF TEMPERATURE PREFERENCE OF FISHES. *Can. J. Fish. Aquatic Sci.* 37(4):733-737. Apr. 1980. SFA 25(2)
[Muddy Run Ecol. Lab., P.O. Box 10, Drumore, PA 17518]

80-001188 Matthews, W. J. and L. G. Hill. HABITAT PARTITIONING IN THE FISH COMMUNITY OF A SOUTHWESTERN RIVER. *Southwest. Nat.* 25(1):51-66. 30 Jan. 1980. SFA 25(2)
[Biol. Stn., Univ. Okla., Norman 73019] Patterns of habitat partitioning and spatial overlap are documented for the fishes of an environmentally unstable southwestern river, *Notropis lutrensis* (red shiner), *Notropis girardi* (Arkansas River shiner), *Hybognathus placitus* (plains minnow), and *Gambusia affinis* (mosquitofish) numerically dominated the fish fauna; few centrarchids or other large species were present. While the dominant

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80-001188 CONTINUED species showed some spatial segregation at most times, their habitat use was transitory, changing as environmental conditions changed. The dominant species made wide use of the avilable habitat during mild environmental conditions and constricted habitat use when physico-chemical conditions were potentially stressful. Species associations were also transitory; no species pairs consistently exhibited strong spatial overlap. Habitat partitioning thus appears less structured in this stream than in more stable environments that have been studied. The fish fauna was characterized by ecologic plasticity, with the most successful species showing marked habitat flexibility.

80-001189 Mundry, P. R. A QUANTITATIVE MEASURE OF MIGRATORY TIMING ILLUSTRATED BY APPLICATION TO THE MANAGEMENT OF COMMERCIAL SALMON FISHERIES. *Ph. D. dissertation, Univ. Wash.* 94p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2563. Dec. 1979. SFA 25(2)

80-001190 Munson, B. H.; J. H. McCormick and H. L. Collins. INFLUENCE OF THERMAL CHALLENGE ON CONDITIONED FEEDING FORAYS OF JUVENILE RAINBOW TROUT. *Trans. Am. Fish. Soc.* 109(1):116-121. Jan. 1980. SFA 25(2)
[U.S. Environ. Prot. Agency, Environ. Res. Lab., 6201 Congdon Blvd., Duluth, MN 55804]

80-001191 North, E. AGGRESSIVE BEHAVIOUR OF JUVENILE BROWN TROUT *SALMO TRUTTA*, L: AN ANALYSIS OF THE WIGWAG DISPLAY. *J. Fish Biol.* 15(5):571-577. Nov. 1979. SFA 25(2)
[Area Fish. Off., Severn-Trent Water Auth., 64 Albert Rd. North, Malvern, Worc's. WR14 1BR, England] The wigwag display of the juvenile brown trout (*Salmo trutta*, L) was analysed and found to be a ritualised display used specifically as a defensive manoeuvre in the aggressive interactions of groups of fish. Wigwag displays performed against fish of lower or equal social rank were highly effective as a defence but wigwags performed against higher ranking fish were less than 50% effective.

80-001192 Partridge, B. L. THE EFFECT OF SCHOOL SIZE ON THE STRUCTURE AND DYNAMICS OF MINNOW SCHOOLS. *Anim. Behav. (Baillière Tindall, Publ.)* 28(1):68-77. Feb. 1980. SFA 25(2)
[Lab. Quant. Biol., Dep. Biol., Univ. Miami, Coral Gables, FL 33124] Varying the number of fish in schools of minnows (*Phoxinus phoxinus*) affects their three-dimensional structure and internal dynamics. Previous authors have suggested that single pairs of fish can be considered a school, but internal organization and structure of two-fish schools are quantitatively different from those for larger schools. Time series analyses show that correlations between fishes instantaneous velocities increase with school size and as interfish distances decrease. Average cross-correlations of fishes' velocities indicate that leader/follower relationships are common in two-fish schools, but they are not seen for schools with more fish in them. Pairs of fish tend to swim one behind another and on the same level, but larger schools take on a more three-dimensional appearance.

80-001193 Partridge, B. L. and T. J. Pitcher. THE SENSORY BASIS OF FISH SCHOOLS: RELATIVE ROLES OF LATERAL LINE AND VISION. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 135(4):315-325. Feb. 1980. SFA 25(2)
[Dep. Biol., Univ. Miami, Coral Gables, FL 33124]

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80-001194 Parzefall, J. ZUR GENETIK UND BIOLOGISCHEN BEDEUTUNG DES AGGRESSIONSVERHALTENS VON *POECILIA SPHENOPS* (PISCES, POECILIIDAE). UNTERSUCHUNGEN AN BASTARDEN OBER-UND UNTERIRDISCH LEBENDER POPULATIONEN. [AGGRESSIVE BEHAVIOUR OF *POECILIA SPHENOPS* (PISCES, POECILIIDAE). STUDIES ON HYBRIDS OF EPIGIOUS AND HYPOGEOUS LIVING POPULATIONS.] *J. Comp. Ethol.* 50(4):399-422. Aug. 1979. SFA 25(2)

[Mus. Univ. Hamburg, Hamburg, West Germany] The aggressive behaviour of hybrids between an epigeous and a cave-dwelling form of the toothcarp *Poecilia sphenops* was investigated in order to test whether a gentically determined reduction of aggressive behaviour exists in the cave population. The scores for five different elements of this behaviour as well as for the duration of fights support this hypothesis and suggest that aggressive behaviour in *Poecilia sphenops* is controlled by a closely linked polygenetic system. On the basis of laboratory and field investigations, to aggressive behaviour is attributed the function of giving large males a reproductive advanage within the framework of a body-size dependent rank order. Small males appear to counteract this one-sided selective advantage through a special strategy of sexual behaviour.

80-001195 Pavlov, D. S. and Yu. N. Sbikin. THE NUMBER OF VISUAL REFERENCE POINTS AND INFLUENCE ON THE MANIFESTATION OF RHEOREACTION IN FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1022-1026. 1978. SFA 25(2)

[IEMEZh, USSR Acad. Sci., Moscow, USSR]

80-001196 Pottle, R. A. and J. M. Green. TERRITORIAL BEHAVIOUR OF THE NORTH TEMPERATE LABRID, *TAUTOGOLABRUS ADSPERSUS*. *Can. J. Zool.* 57(12):2327-2347. Dec. 1979. In English with French summ. SFA 25(2)

[J. M. Green: Mar. Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, NF A1B 3X9, Canada] A study of territorial behaviour of the cunner, *Tautogolabrus adspersus*, was carried out in Conception Bay, Newfoundland, in 1977 and 1978. Cunners that overwinter in a torpid state were active only from May to late October of both years. Large males established territories prior to the midsummer spawning season and territories were defended throughout and after that season. Territory size ranged from 16.1 to 74.3 m^2 on rocky substrate at depths of 0.7 to 13 m and did not vary significantly with either the size of the resident fish or the degree of intraspecific aggression it exhibited. Nonterritorial males were generally smaller than territorial males and were vigorouly excluded from their territories. Only territorial males exhibited interspecific aggression, which was most frequent toward *Pholis gunnellus*. Territorial females were present in the peripheral areas of some males' territories and were aggressive toward other females. Tagging indicated that most males and some females defend the same territory from year to year, and that territory size remains relatively constant. The proportions of territorial and nonterritorial fish, of either sex, in the population are unknown. The primary function of territorial behaviour in *T. adspersus* may be the provision of a spawning site from which potential rivals are excluded.

80-001197 Reynolds, W. W. and M. E. Casterlin. BEHAVIORAL THERMOREGULATION AND LOCOMOTOR ACTIVITY OF *PERCA FLAVESCENS*. *Can. J. Zool.* 57(11):2239-2242. Nov. 1979. In English with French summ. SFA 25(2)

[Cent. Life Sci., Univ. New England, Biddeford, ME 04005] Ten yearling yellow perch (*Perca flavescens*) were tested individually for 3-day periods in electronic shuttleboxes to determine their diel patterns of behavioral thermoregulation and of locomotor activity relative to a natural April photoperiod, and to determine the relationship between preferred temperatures and activity. The perch exhibited a diel rhythm of preferred temperature, with a predawn minimum of 16.7°C and a dusk maximum of 23.8°C. The 24-h mean was 20.2°C; the diurnal mean was 21.5°C and the nocturnal mean was 18.5°C. Locomotor activity (quantified as mean

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80-001197 CONTINUED photocell-monitored light-beam interruptions per hour) was crepuscular, with a major peak (25 units/h) at dusk, and a smaller peak (14.4 units/h) at dawn. Nocturnal activity was slightly greater (5.3 units/h) than diurnal activity (4.4 units/h). Locomotor activity relative to temperature exhibited a local minimum (0.4-6.2 units/h) at 22.2°C.

80-001198 Sazima, I. and V. S. Uieda. IS THE NIGHT-TIME RESTING BEHAVIOR OF YOUNG NEEDLEFISH AN EXAMPLE OF NOCTURNAL DISGUISE? *Biotropica* 11(4):308-309. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. Estradual Campinas, 13100 Campinas, São Paulo, Brazil]

80-001199 Sazima, I. BEHAVIOR OF TWO BRAZILIAN SPECIES OF PARODONTID FISHES, *APAREIODON PIRACICABAE* AND *A. IBITIENSIS*. *Copeia* 1980(1):166-169. 1 Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Estud. Campinas, 13 100 Campinas São Paulo, Brazil]

80-001200 Stascheit, M. TEMPERATURE DEPENDENCE OF MEMORY IN FISH. *J. Comp. Ethol.* 51(2):140-152. Oct. 1979. SFA 25(2)
[Zool. Inst., Univ. Münster, Abt. Verhaltensforsch., Bodestraße 9, D-4400 Münster, West Germany] The influence of temperature on the retention period of a pattern discrimination task (cross versus triangle) was examined on *Carassius carassius*, *Cichlasoma nigrofaciatum* and *Phoxinus phoxinus*. After training at optimal temperature conditions the experimental subjects were kept at a 10°C lowered temperature, whereas for control subjects there was no temperature change. Tests, carried out every two weeks, showed a significant increase of retention for *Carassius c.* and *Cichlasoma n.*; *phoxinus p.* showed a slightly more rapid forgetting. These results and investigations of oxygen-uptake indicate a direct dependence of memory processes on the metabolic level.

80-001201 Stevens, E. D. THE EFFECT OF TEMPERATURE ON TAIL BEAT FREQUENCY OF FISH SWIMMING AT CONSTANT VELOCITY. *Can. J. Zool.* 57(8):1628-1635. Aug. 1979. In English with French summ. SFA 25(2)
[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada] Rainbow trout and largemouth bass were swum at fixed swim speeds from one to three body lengths per second at ambient water temperatures from 5 to 35°C. Tail beat frequency was measured during steady swimming. Both tail beat frequency and stride length (distance moved per tail beat) increased with increased swim speed. In trout tail beat frequency was lower at higher water temperatures, whereas in bass tail beat frequency was higher at higher water temperatures. In both trout and bass tail beat frequency was lower in fish acclimated to a higher temperature. I suggest that when test temperature is above acclimation temperature the muscle operates high on the force-velocity curve; and when test temperature is below acclimation temperature the muscle operates low on the force-velocity curve.

80-001202 Takamura, K. [UTILIZATION OF HABITAT BY YOUNG PALE CHUB, *ZACCO PLATYPUS* (TEMMINCK ET SCHLEGEL) (PISCES: CYPRINIDAE)]. *Jpn. J. Ecol.* 29(3):295-306. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Dep. Zool., Fac. Sci., Kyoto Univ., Kyoto 606, Japan]

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80-001203 Webb, P. W. DOES SCHOOLING REDUCE FAST-START RESPONSE LATENCIES IN TELEOSTS? *Comp. Biochem. Physiol. A Comp. Physiol.* 65(2):231-234. 1980. SFA 25(2)

[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109] Response latencies, defined as the time between a d.c. electric shock and initiation of a fast-start (startle response) were measured for eight species of teleosts. Fast-start response latencies varied from 10 to 36 cm. Highest values were found for individuals of two solitary species, *Etheostoma caeruleum* and *Cottus cognatus*. Lowest values were found for *Esox* and *Salmo gairdneri*. Schooling in *Perca flavescens*, *Lepomis macrochirus* and *Pimephales promelas* significantly reduced fast-start response latencies by 7-16 msec. A 4 msec. reduction for *Notropis cornutus* was not significant. No reduction in fast-start response latency was found for *Pimephales promelas* given the illusion of a school or for individuals greater than 15 cm from a school. The observed variation in fast-start response latency would favour attack success of predators and escape success for schooled, but not solitary, presumptive prey.

LIFE HISTORY-GENERAL WORKS

80-001204 Capapé, C. LA TORPILLE MARBRÉE, *TORPEDO MARMORATA* RISSO, 1810 (PISCES, RAJIFORMES) DES CÔTES TUNISIENNES: NOUVELLES DONNÉES SUR L'ÉCOLOGIE ET LA BIOLOGIE DE LA REPRODUCTION DE L'ESPÈCE, AVEC UNE COMPARAISON ENTRE LES POPULATIONS MÉDITERRANÉENNES ET ATLANTIQUES. [THE MARBLE RAY, *TORPEDO MARMORATA* RISSO 1810 (PISCES, RAJIFORMES) OF THE TUNISIAN COASTS: NEW DATA ON ECOLOGY AND BIOLOGY OF REPRODUCTION OF THE SPECIES WITH A COMPARISON BETWEEN MEDITERRANEAN AND ATLANTIC POPULATIONS.] *Ann. Sci. Nat. (Zool.) 13 Ser.* 1(2):79-97. Apr.-June 1979. In French with English summ. SFA 25(2)

[Inst. Pasteur, Tunis, Tunisia]

80-001205 Beecher, H. A. COMPARATIVE FUNCTIONAL MORPHOLOGY AND ECOLOGICAL ISOLATING MECHANISMS IN SYMPATRIC FISHES OF THE GENUS *CARPIODES* IN NORTHWESTERN FLORIDA. *Ph. D. dissertation, Fla. State Univ.* 219p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2557. Dec. 1979. SFA 25(2)

80-001206 Brandt, S. B. THERMAL ECOLOGY AND ABUNDANCE OF ALEWIFE (*ALOSA PSEUDOHARENGUS*) IN LAKE MICHIGAN. *Ph.D. dissertation, Univ. Wis.* 248p. 1978. From Diss. Abstr. Int. B Sci. Eng. 40(6):2479. Dec. 1979. SFA 25(2)

The purpose of this research was to examine abundance, vertical distribution, resource utilization, and thermal ecology of alewife in Lake Michigan. Both *Mysis* and adult alewife concentrated near the bottom during day and migrated up to the thermocline at night. The extent and rates of vertical migrations by *Mysis* and alewife coincided. At night adult alewife fed extensively on *Mysis*. *Mysis* in alewife stomachs were larger than those captured in vertical plankton tows. *Pontoporeia hoyi* were present in a higher proportion of alewife stomachs in late afternoon during September and early evening in June and October than during night and morning. Microcrustacean zooplankton were eaten mostly during day in June or early morning in October rather than at night. During the day young of the year (YOY) alewife concentrated at epilimnial temperatures of 17-19 C and adults inhabited thermocline temperatures of 11-14 C. Bathymetric distributions shifted in response to inshore-offshore movements of the position of the intersection of the thermocline with the bottom. Both adults and YOY apparently migrated into midwater at night. Calanoid copepods, cyclopoid copepods and *Daphnia* sp. were numerically dominant in YOY alewife diet and were eaten primarily during the day. Adult alewife fed on

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80-001206 CONTINUED microcrustacean zooplankton, *Mysis* and *Pontoporeia*. *Daphnia* sp. were numerically the most abundant prey and more were eaten during the day than at night. Observed distributions stress the importance of thermal structure, food abundance, and potential intraspecific and interspecific interactions. Results on distribution were used to determine sampling design and data stratification for an acoustic estimate of total alewife abundance in the southern basin of Lake Michigan. From October 16-28, 1976, estimated fish densities ranged from 0 to approximately .058 fish/m^3. Mean densities within temperature, depth and geographic strata were .0009 to .00131 fish/m^3. Fish density increased in the thermocline, particularly near the intersection of the thermocline with the bottom. The total number of pelagic fish in the southern basin was estimated at 4.9735 ± .3952 x 10^8. Assuming that all fish were alewife and that mean alewife weight was 42.9, then the total biomass was 21,336 metric tons. Day bottom trawl catches were 3.6-14.1% of that predicted acoustically.--From abstr.

80-001207 Case, G. R.; V. R. Koestler and R. J. Koestler. THE SHORTCHANGED SHARK. *Underwater Nat.* 12(2):10-14. 1980. SFA 25(2)

80-001208 Clay, D. POPULATION BIOLOGY, GROWTH AND FEEDING OF AFRICAN CATFISH (*CLARIAS GARIEPINUS*) WITH SPECIAL REFERENCE TO JUVENILES AND THEIR IMPORTANCE IN FISH CULTURE. *Arch. Hydrobiol.* 87(4):453-482. 1979. SFA 25(2)

[Dep. Agric., Univ. Rhodesia, Salisbury, Rhodesia] Length-frequency analysis of juvenile *Clarias gariepinus*, from Lake McIlwaine, Rhodesia, indicates that they carried out multiple spawning in 1974 and 1975. Temperature preference was found to be 32.7±1.5°C. Preferred temperature may be actively sought by the juveniles who remain in the shallows until 15 to 22 cm. Recruitment from the shallows to the offshore population occurs between about 15 to 22 cm. The smallest ripe male was 25 cm and ripe female was 28 cm. As it has been noted that sex may be identified internally on fish over 13 cm, it may be that recruitment to the adult population is a function of sexual development and feeding biology, both of which are governed by temperature. Growth was estimated to be 15 cm in the first 6 months (warm water period), slowing to a total of only 18 to 20 cm in 9 months (which includes the cold water period). A change in the length-mass relationship occurs at 10 cm. This is probably another indication that sexual maturity occurs around 10 to 14 cm. Fish of 4 to 10 cm give the length-mass relationship $Y = 3.623 \times 1/10^4 \times^{2.09}$ and fish 10 to 34 cm give the relationship $Y = 2.834 \times 1/10^6 \times^{3.18}$ where Y is the mass in grams and X is the total length in millimetres. Catfish were found to be opportunistic feeders, varying their food according to availability. Maximum prey size bears a straight line relationship to fish length. Juvenile catfish are recommended as a suitable fish for tropical aquaculture because they can survive low dissolved oxygen levels, can be marketed live, can withstand high diurnal temperature fluctuations, prefer very warm water, are able to utilize various trophic levels in a pond, and have rapid growth allowing a skimming type harvest.

80-001209 Copes, F. A. ECOLOGY OF THE BRASSY MINNOW *HYBOGNATHUS HANKINSONI* (CYPRINIDAE). *Mus. Nat. Hist. Univ. Wis. (Stevens Point) Rep. Fauna Flora Wis.* No. 10(part 3). p. 47-72. 1975. SFA 25(2)

[Dep. Biol., Univ. Wis., Stevens Point 54481]

LIFE HISTORY-GENERAL WORKS

80-001210 Copes, F. C. ECOLOGY OF THE CREEK CHUB. *Mus. Nat. Hist. Univ. Wis. (Stevens Point) Rep. Fauna Flora Wis.* No. 12. 21p. 30 Apr. 1978. SFA 25(2)
[Dep. Biol., Univ. Wis., Stevens Point 54481]

80-001211 Dadswell, M. J. BIOLOGY AND POPULATION CHARACTERISTICS OF THE SHORTNOSE STURGEON, *ACIPENSER BREVIROSTRUM* LESUEUR 1818 (OSTEICHTHYES: ACIPENSERIDAE), IN THE SAINT JOHN RIVER ESTUARY, NEW BRUNSWICK, CANADA. *Can. J. Zool.* 57(11):2186-2210. Nov. 1979. In English with French summ. SFA 25(2)
[Fish. Oceans Can., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] During a 4-year study, 4178 shortnose sturgeon were captured and 2453 marked with numbered tags and released. For adults, Z was estimated as 0.12-0.15 and F was estimated as 0.01. The population weight-length relationship was log W = 3.21(log FL) - 5.45, where W = weight in kilograms and FL = fork length in cm. The oldest female was 67 years; the oldest male was 32 years. Von Bertalanffy growth parameters L_∞, W_∞, and K were 127.0 cm, 24.8 kg, and 0.047 for females, and 108.7 cm, 13.9 kg, and 0.063 for males. Sex ratio of adults was 2:1 for females. Males spawned first about age 12 and probably at 2-year intervals thereafter; females spawned at 18 years and 3- to 5-year intervals thereafter. Fecundity was 27,000-208,000 eggs per female. Spawning occurs in freshwater, riverine sections of the upper estuary during May-June at 10-15°C. Feeding occurred only during May to October in fresh water but continued all year in saline water. Juveniles ate mainly insects and crustaceans; adults ate small molluscs. Juveniles remained in fresh water until they attained 45 cm, then joined the regular annual migration of adults, which moved upstream in spring-summer and seaward in fall. Many ripening females migrated upstream in fall and overwintered in deep, freshwater sites adjacent to spawning grounds. The Seber-Jolly estimate of the adult (>50 cm) population was 18,000 ± 30%.

80-001212 Dauble, D. D. LIFE HISTORY OF THE BRIDGELIP SUCKER IN THE CENTRAL COLUMBIA RIVER. *Trans. Am. Fish. Soc.* 109(1):92-98. Jan. 1980. SFA 25(2)
[Freshwater Sci., Ecosyst. Dep., Battelle, Pac. Northwest Lab., Richland, WA 99352]

80-001213 Dees, L. T. SEA LAMPREY. *U.S. Fish Wildl. Serv. Great Lakes Fish. Lab. Contrib.* 546. 7p. 1980. SFA 25(2)
[838 N. Woodrow, Arlington, VA]

80-001214 Dewberry, T. C. SOME ASPECTS OF THE POPULATION ECOLOGY OF THE SMALLMOUTH BASS IN A SMALL MICHIGAN STREAM. *M.S. thesis, Mich. State Univ.* 75p. 1978. From Masters Abstr. 17(4):246. Dec. 1979. SFA 25(2)
The population of large smallmouth bass appeared to vary greatly throughout the year in Spring Brook. THe most plausible explanation was that the fish were migratory. Mark-and-recapture electrofishing inventories were conducted in April, June, and September. A weir with two-way fish traps was maintained from April into September. The data indicated the large smallmouth bass were not migratory. They did move considerably during the year but movement was generally limited to about 1 km. Analysis of their habitat requirements provided an explanation for the movement. An investigation of the geology and hydrology of the drainage basin provided an explanation for the distribution of smallmouth bass in Spring Brook. The size of crayfish eaten by the rockbass and smallmouth bass, combined with field observations, suggested that Age-I and II smallmouth bass fed primarily in riffles; while the rockbass predominantly fed in the vegetational areas along the stream margin.

LIFE HISTORY-GENERAL WORKS

80-001215 Eldon, G. A. BREEDING, GROWTH, AND AESTIVATION OF THE CANTERBURY MUDFISH, *NEOCHANNA BURROWSIUS* (SALMONIFORMES: GALAXIIDAE). *N.Z. Mar. Freshwater Res.* 13(3):331-346. 1979. SFA 25(2)

[Fish Res. Div., Minist. Agric. Fish, Christchurch, New Zealand] *Neochanna burrowsius* (Phillipps) breeds in late winter and spring. Eggs are widely scattered, and adhere to leaves, stems, and suspended roots of aquatic and bankside vegetation in the sluggish or still waters of the adult habitat. Fish were successfully bred in ponds and tanks; hatching time for eggs varied greatly under different conditions of light and temperature. Fry are free swimming until they adopt the nocturnal, cryptic habits of adults when 30-50 mm long. Growth in the first year is rapid, sexual maturity being reached at 1 year old; subsequent growth is slow. Aestivation occurred successfully in shaded vegetable detritus or gravel. Holes were sometimes used, but fish did not make their own burrows for aestivation. When dissolved oxygen was low, captive fish left the water if able to do so without leaving cover.

80-001216 Gibson, R. N. and I. A. Ezzi. ASPECTS OF THE BIOLOGY OF THE SPOTTED DRAGONET *CALLIONYMUS MACULATUS* RAFINESQUE-SCHMALTZ FROM THE WEST COAST OF SCOTLAND. *J. Fish Biol.* 15(5):555-569. Nov. 1979. SFA 25(2)

[Dunstaffnage Mar. Res. Lab., Oban, Argyll, Scotland] The biology of a Scottish population of the spotted dragonet *Callionymus maculatus* was studied from Febrary 1975 to September 1976. The data were taken from monthly samples totalling over 700 fish trawled in 18-36 m on a soft mud bottom. Neither otoliths nor radial bones were found to be suitable for age determination, but evidence from other sources suggested that most growth takes place in the first two years of life and that males grow faster, but do not live as long (at least 3 years) as females (at least 5 years). Examination of the gonads showed that the spawning season probably lasts from April to September, that females mature earlier in life than males and are serial spawners. The males may reach first maturity at different ages. The sexes are markedly dimorphic. The rays of the dorsal, anal and caudal fins grow isometrically in females but growth of these organs in males is allometric after maturity has been achieved. The fish feeds predominantly on polychaetes and amphipods, although bivalve molluscs, macruran decapods and ophiuroids also occur frequently in its diet. There is some difference in the diet between length classes, smaller fish taking fewer polychaetes and more amphipods than the larger individuals. The species is finally compared with other dragonets whose biology is known.

80-001217 Goto, A.; K. Oishi and K. Takata. [BREEDING HABITS, GROWTH AND FOOD OF THE NINESPINE STICKLEBACK, *PUNGITIUS PUNGITIUS* (L.) IN AN ARTIFICIAL WATERWAY OF THE KUNEBETSU RIVER SYSTEM, HOKKAIDO.] *Bull. Fac. Fish. Hokkaido Univ.* 30(4):239-251. Nov. 1979. In Japanese with English summ. SFA 25(2)

[Lab. Embryol. Genet., Fac. Fish., Hokkaido Univ., Hakodate, Japan] The breeding habits, growth and food of the ninespine stickleback, *Pungitius pungitius* (L.), were studied in an artificial waterway of the Kunebetsu River System of Hokkaido, Japan, in order to find out the characteristics of the life history of this species. In 1978, they spawned from middle May to late June. The spawning nests were observed nearly at the root of the aquatic rooted vegetation such as *Phalaris arundinacea*, growing on the shore with moderate water current, 30 to 50 cm in depth. The fecundity of an adult female was about 40 to 80 eggs (average 57 eggs), and the egg diameter of fully riped ovarian eggs ranged from 1.3 to 1.7 mm. The deposited eggs hatched for 8 to 9 days in the water temperature of 14° to 19°. After hatching, the fry still remained in the nest for about one week, then they moved into the open water. The fry grew rapidly during the summer season. Their growth, however, became slow during the autumn and winter seasons, and seemed to almost stop until the next spring. During the spring season, the young again grew rapidly and matured. After the spawning, all seemed to die

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80-001217 CONTINUED within a month. The food of this species changed in accordance with their development. The fry in the post larval stage fed mainly on small Crustacea such as *Chylorus* and *Cyclops*. In the juvenile stage, gradual change in the food habits to feed Chironomid larvae was observed. The young fed mainly on Chironomid larvae during the autumn (September and November) and on *Asellus* during the winter (December). The next spring, their stomachs were filled with Chironomid larvae again. The adult utilized Chironomid larvae and small Crustacea as main foods. From the results stated above, it was supposed that the population of *Pungitius pungitius* in this waterway had a remarkably short life span and had the reproductive strategy that a female spawned a great number of small-sized eggs, compared with the populations in the other localities such as North America and Europe.

80-001218 Gray, R. H. and D. D. Dauble. BIOLOGY OF THE SAND ROLLER IN THE CENTRAL COLUMBIA RIVER. *Trans. Am. Fish. Soc.* 108(6):646-649. Nov. 1979. SFA 25(2)

[Freshwater Sci., Ecol. Sci. Dep., Battelle Pac. Northwest Lab., Richland, WA 99352]

80-001219 Guillory, V. LIFE HISTORY OF WARMOUTH IN LAKE CONWAY, FLORIDA. *Proc. Annu. Conf. SOutheast. Assoc. Fish Wildl. Agencies* 32:490-501. 1978[1979]. SFA 25(2)

[La. Dep. Wildl. Fish., P.O. Box 37, Grand Isle] Life history data were collected on Lake Conway warmouth (*Lepomis gulosus*) from May 1976 to August 1977. Dominant food items progressed from zooplankton to insects to crayfish with warmouth size. The sex ratio was 1.87 males to 1.00 females. Spawning was protracted, extending from April to August. Fecundity increased with length and ranged from 304 tp 8504 (mean = 1981). Condition factor increased directly with length. Length-weight regressions were computed separately for warmouth less than and greater than 100 mm. Age structure was not discernible. No warmouth fishery existed.

80-001220 Hamre, J. and T. Monstad. LODDEUNDERSØKELSER I BARENTSHAVET VINTEREN 1979. [CAPELIN INVESTIGATIONS IN THE BARENTS SEA DURING WINTER 1979.] *Fisken Havet* 1979(4):3-17. 1979. In Norwegian with English summ. SFA 25(2)

[Inst. Mar. Res., Bergen, Norway]

80-001221 Hartman, F. THREE SPINES ON A STICKLEBACK. *Nat. Hist.* 88(10):32-35. Dec. 1979. SFA 25(2)

80-001222 Healey, M. C. UTILIZATION OF THE NANAIMO RIVER ESTUARY BY JUVENILE CHINNOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*. *NOAA Fish. Bull.* 77(3):653-668. July 1979. SFA 25(2)

[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Chinook salmon are considered, normally, to spend from a few months to a year rearing in freshwater before migrating to sea. Although large downstream movement of fry, recently emerged from spawning gravels, has been observed in several river systems, it has been suggested that most of these migrant fry are lost to the population. This report describes the fate of downstream migrant chinook salmon fry in the Nanaimo River, British Columbia. In 1975 and 1976 most of the potential fry production from the river system was estimated to have passed by a trapping location near the river mouth. Many of these fry

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80-001222 CONTINUED were subsequently found rearing in the intertidal area at the river mouth where salinity was commonly above 20 °/oo. Very few chinook salmon fry were captured at other sampling sites within a 10 km radius of the river mouth. Juvenile chinook salmon were present in the intertidal area of the estuary from March to July each year, but peak numbers occurred in April and May. Peak estuary population was estimated to be 40,000-50,000 in 1975 and 20,000-25,000 in both 1976 and 1977. While in the estuary, chinook salmon grew about 1.32 mm per day or 5.8% of their body weight per day. Individual fish probably spent an average of about 25 days rearing in the estuary and left the estuary when about 70 mm fork length. While in the estuary, juvenile chinook salmon fed on harpacticoid copepods, amphipods, insect larvae, decapod larvae, and mysids. After leaving the estuary, they fed mainly on juvenile herring. The stomach content of chinook salmon captured in the estuary averaged 5% of body weight or less, and varied seasonally and between years. It appears that in the Nanaimo and probably in other systems with well-developed estuaries, that the estuary is an important nursery for chinook salmon fry.

80-001223 Hoyt, R. D.; A. J. Waite and B. M. DiPasquale. POPULATION DYNAMICS AND CATCH SUSCEPTIBILITY OF SMALLMOUTH BUFFALO IN ROUGH RIVER RESERVOIR. *Ky. Dep. Fish. Wildl. Resour. Fish. Bull.* No. 62. vii + 67p. 1976. SFA 25(2)

[Dep. Biol., West. Ky. Univ., Bowling Green 42101] The population dynamics of the smallmouth buffalo in Rough River Reservoir (= Lake) were studied from July 1974 through June 1976. One thousand four hundred ten smallmouth buffalo were recovered from 51 collections. The population in the lake was estimated to range from 135,000 to 194,000 fish and was considered to be an underestimate. Eleven year classes were represented with the majority in two age groups. Year classes spawned in 1969-70 dominated, comprising 70% of the population. No individual less than 200 mm total length were taken. Growth in length was greatest during the first four years of life, while growth in weight was greatest in years V through XI. Growth in length and weight decreased from the first to second year of the study. Eighty-five percent of all specimens ranged from 400 to 550 mm TL. This group included fish from three through eight years of age. Fish spawned in 1965-67 showed greater first year's growth than did the remaining year classes. Condition was greatest in the smaller size individuals and progressively decreased in the larger, older individuals. Females were in slightly better condition than males. The buffalo appeared to be overcrowded and showed reduced growth from 400 mm TL and longer. Movements were greatest during March and April when fish congregated in headwater effluents to spawn. Flag nets were the most efficient type of tackle used while 3-inch mesh was the most efficient mesh size. The largest average size fish were taken in 4-inch mesh. Spawning occurred from mid-March through May. Males reached sexual maturity in the life cycle and annual reproductive condition earlier than females. Gonad development was bimodal, being closely correlated with water temperature and photoperiod. Larger, older females produced the greatest number and largest diameter mature ova. Reproductive development did not appear to be adversely affected by the population structure and density. Selective harvesting of three- to five-pound buffalo is recommended to restore a balanced age group structure and eliminate year class dominance.

80-001224 Joseph, J.; W. Klawe and P. Murphy. TUNA AND BILLFISH--FISH WITHOUT A COUNTRY. *Inter-Am. Trop. Tuna Comm., La Jolla, CA* vii + 46p. 1979. Available @ $7.95 from Inter-American Tropical Tuna Commission, P.O. Box 1529, La Jolla, CA 92093. SFA 25(2)

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80-001225 Khalturin, D. K. SMOLT AGE AND THE DURATION OF THE MARINE PERIOD IN THE LIFE OF ANADROMOUS SALMONIDS (SALMONIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):871-885. 1978. SFA 25(2)
[Zool. Inst., USSR Acad. Sci., Leningrad, USSR] We know that the great variability in life history parameters of *Salmo* and *Oncorhynchus* stocks are due to many factors. Within species these may be provisionally subdivided into the following factors: 1) geographic variability - zonal-climatic differences in the ecology of the salmon stocks of one region; 2) populational variability - features of genetic differentiation of the stock and of its constituent populations. The life cycle of salmon and, in particular, smolt age, frequently turns out to be specific even in adjacent rivers in the same basin and they usually reflect differences in the temperature and feeding conditions of the waters. Nevertheless, the relationship between the time spent by the salmon before migration to the sea and the time spent in the sea is a question that is of interest in its own right.

80-001226 Lindquist, D. G. and G. T. Chandler. LIFE HISTORY ASPECTS OF THE CRESTED BLENNY, *HYPLEUROCHILUS GEMINATUS* (WOOD). *J. Elisha Mitchell Sci. Soc.* 94(2):111-112. 1978. Abstract only. SFA 25(2)

80-001227 Moreno, C. A. OBSERVATIONS ON FOOD AND REPRODUCTION IN *TREMATOMUS BERNACCHII* (PISCES: NOTOTHENIIDAE) FROM THE PALMER ARCHIPELAGO, ANTARCTICA. *Copeia* 1980(1):171-173. 1 Feb. 1980. SFA 25(2)
[Inst. Ecol. Evol., Univ. Austral Chile, Casilla 567, Valdivia, Chile]

80-001228 Ortega-Salas, A. A. SEASONAL CHANGES IN THE COMMON DAB, *LIMANDA LIMANDA* (L.) IN ISLE OF MAN WATERS. *J. Fish Biol.* 16(1):75-82. Jan. 1980. SFA 25(2)
[Cent. Ciencias del Mar Limnol., U.N.A.M. Mexico 20, D.F. Mexico] Otolith accretion was greatest in summer when opaque bands were laid down and slowest in winter when hyaline rings were formed. Food intake was minimal in winter and maximal in summer. Liver weight was high in summer and winter and low in spring after spawning. Growth in length was higher in summer than winter. Gonad weight was greatest in winter for both sexes. Spawning occurred from February to April. After spawning males recovered earlier than females and testes ripened earlier than the ovaries. From winter to summer, the sea temperature increased from 7.5-13.0°C; the day length from 7-17 h; and the salinity varied from 34.07-34.36°/oo.

80-001229 Pasch, R. W.; P. A. Hackney and J. A. Holbrook II. ECOLOGY OF PADDLEFISH IN OLD HICKORY RESERVOIR, TENNESSEE, WITH EMPHASIS ON FIRST-YEAR LIFE HISTORY. *Trans. Am. Fish. Soc.* 109(2):157-167. Mar. 1980. SFA 25(2)
[Div. Water Resour., TVA, Norris, TN 37828]

80-001230 Patnaik, S. and S. Jena. SOME ASPECTS OF BIOLOGY OF *LATES CALCARIFER* (BLOCH) FROM CHILKA LAKE. *Indian J. Fish.* 23(1/2):65-71. 1976. SFA 25(2)
[Cent. Inland Fish. Res. Substn., Cuttack, Orissa, India] *Lates calcarifer* (Bloch) locally known as bhekti is a carnivore. While the adult fish feeds on fishes and prawns, the chief food of fry and fingerlings are copepods and mysids respectively. The general length-weight relationship followed the cube law. Maturing specimens have been observed during April-July. Ova-diameter studies revealed a single group of mature ova, indicating single spawning by each individual. The mature ovary produced on an average 0.76 million eggs per kg of fish. Bhekti is a catadromous species.

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80-001231 Rivas, L. R. and D. McClellan. SUMMARY OF RESEARCH ON WESTERN NORTH ATLANTIC SHARKS CONDUCTED BY THE NATIONAL MARINE FISHERIES SERVICE, SOUTHEAST FISHERIES CENTER, MIAMI LABORATORY. *Fla. Sci.* 43(Suppl. 1):11. 1980. Abstract only. SFA 25(2)
[NMFS, 75 Virginia Beach Dr., Miami, FL 33149]

80-001232 Ryan, J. J. THE COD FAMILY AND ITS UTILIZATION. *Mar. Fish. Rev.* 41(11):25-36. Nov. 1979. SFA 25(2)
[NMFS, Emerson Ave., Gloucester, MA 01930]

80-001233 Smith-Pollard, L. PADDLEFISH. *Outdoor Okla.* 36(3):16-20. Mar. 1980. SFA 25(2)

80-001234 Tsyplakov, E. P. MIGRATIONS AND DISTRIBUTION OF THE STERLET, *ACIPENSER RUTHENUS*, IN KUYBYSHEV RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):905-912. 1978. SFA 25(2)
[Tatar Dep., State Res. Inst. Lake River Fish., Kazan, USSR] The former beds of the Volga and the Kama, and also the backwaters, are the principal habitats of the sterlet, *Acipenser ruthenus*, in Kuybyshev reservoir. The emergence of large numbers of the sterlet onto the flooded plain is to be seen only in the spring, when the sterlet consumes eggs laid by bream, roach and white bream. The sterlet typically forms dense concentrations in its winter areas. A description is given of two such areas in the Volga and the Volga-Kama arms of the reservoir. The migratory capacities of the sterlet have begun to be more clearly manifested since the formation of the reservoir; this has been a reaction of the population to the deterioration of the conditions of reproduction and it is conducive to the utilization of all the remaining spawning grounds.

80-001235 Warden, R. L., Jr. and W. A. Hubert. COMPARATIVE LIFE HISTORY FEATURES OF YOUNG-OF-YEAR SMALLMOUTH AND LARGEMOUTH BASS IN PICKWICK RESERVOIR. *J. Tenn. Acad. Sci.* 55(2):58-60. Apr. 1980. SFA 25(2)
[TVA, Muscle Shoals, AL 35660] Life history features were compared for young-of-year smallmouth and largemouth bass in Pickwick Reservoir, Alabama. Length-weight relations, condition factors, and lengths at collection were similar for both species during their first summer. Smallmouth bass from 20 to 99 mm (TL) depended heavily on Tendipedidae and Ephemeroptera for food; while largemouth bass in the same size category shifted with growth from crustaceans, to aquatic insects, to insects and fish. Both bass species were collected throughout the reservoir, and differential habitat preference were observed.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

80-001236 Côté, G.; P. Lamoureux; J. Boulva and G. Lacroix. SÉPARATION DES POPULATIONS DE HARENG DE L'ATLANTIQUE (*CLUPEA HARENGUS HARENGUS*) DE L'ESTUAIRE DU SAINT-LAURENT ET DE LA PÉNINSULE GASPÉSIENNE. [SEPARATION OF POPULATIONS OF ATLANTIC HERRING (*CLUPEA HARENGUS*) IN THE ST. LAWRENCE ESTUARY AND THE GASPÉ PENINSULA.] *Can. J. Fish. Aquatic Sci.* 37(1):66-71. Jan. 1980. In French with English summ. SFA 25(2)
[Minist. Pêch. Océans, C.P.-15500, Québec City, PQ G1K 7Y7, Canada]

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80-001237 Ager, L. M. EXPLOITATION AND MORTALITY OF LARGEMOUTH BASS IN LAKE TOBESOFKEE, GEORGIA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:429-436. 1978[1979]. SFA 25(2)

[Ga. Dep. Nat. Resour., Fort Valley 31030] Estimates of mortality and survival obtained from angler tag returns over a 10-month period following tagging were used to define the population changes that occurred in the largemouth bass (*Micropterus salmoides*) population of Lake Tobesofkee. Total mortality (A) of 30-cm and larger fish over the period was estimated at 0.911 and the exploitation rate (u) of these sizes was 0.564. The conditional rate of natural mortality was 0.602. These estimates were used to predict the relative abundance of various sizes of largemouth based on 1977 harvest and abundance data. Also the effects of various minimum length limits were predicted. Increased minimum legal size would have cut harvest to 23.7% and increased survival from 0.089 to 0.308.

80-001238 Alaska Department of Fish and Game. PRELIMINARY FORECASTS AND PROJECTIONS FOR 1980 ALASKAN SALMON FISHERIES. *Alaska Dep. Fish Game Inf. Leafl.* No. 183. i + 37p. Jan. 1980. SFA 25(2)

[Div. Commercial Fisheries, Juneau 99801] In 1979 commercial fishermen harvested 86 million salmon in Alaska, the largest catch since 1943. Statewide, the salmon harvest increased for the fifth consecutive year. A commercial harvest of 103 million salmon is projected for Alaska in 1980. The catch is not expected to be less than 60 million, nor to exceed 130 million fish. Based on projection experience since 1970, only 1 of 4 realized harvests would fall outside this range. A very large harvest of sockeye and pink salmon is anticipated in Bristol Bay, and more pink salmon are expected to return to Kodiak Island and the south side of the Alaska Peninsula. Significantly decreased salmon harvests are anticipated in Cook Inlet, Prince William Sound, and Southeastern Alaska areas.

80-001239 Barker, M. W. POPULATION AND FISHERY DYNAMICS OF RECREATIONALLY EXPLOITED MARINE BOTTOMFISH OF NORTHERN PUGET SOUND. *Ph. D. dissertation, Univ. Wash.* 143p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2497. Dec. 1979. SFA 25(2)

80-001240 Borisov, V. M. THE SELECTIVE EFFECT OF FISHING ON THE POPULATION STRUCTURE OF SPECIES WITH A LONG LIFE CYCLE. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol)* 18(6):896-904. 1978. SFA 25(2)

[VNIRO, Moscow, USSR] The relative contribution made to the reproduction of a stock by spawners maturing for the first time at an age of 6, 8 and 11 years is analyzed with reference to one year-class of the Atlantic (Arctic-Norwegian) cod, *Gadus morhua morhua*. Under conditions of intensive exploitation in which total annual mortality reaches 65%, the numbers of the late-maturing subgroup are reduced to such an extent over 7 years as to make practically no contribution to reproduction (the medium-maturing subgroup is fished for 4 years before incorporation in the spawning stock, the early-maturing subgroup for 2 years). The relative contribution to reproduction of fish maturing early is, conversely, increased. Selection for early maturation is leading to a reduction in the age of the population with all the attendant adverse consequences.

80-001241 Bruger, G. E. PRELIMINARY ANALYSES OF SNOOK, *CENTROPOMUS UNDECIMALIS*, POPULATION DYNAMICS IN THE NAPLES-MARCO ISLAND REGION OF SOUTHWEST FLORIDA. *Fla. Sci.* 43(Suppl. 1):25. 1980. Abstract only. SFA 25(2).

[Fla. Dep. Nat. Resour. Mar. Res. Lab., 100 8th Ave. S.E., St. Petersburg 33701] Snook, *Centropomus undecimalis*, have been tagged in the

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80-001241 CONTINUED Naples-Marco Island area seasonally since 1976 to assess population size, fishing and natural mortalities, movement, and growth (> 4,300 fish tagged; 14.7% average return rate). Preliminary analyses indicate that snook in this area constitute a small, heavily exploited sub-population. These fish are non-migratory (90% recaptured within 10 mi), but do make annual movements from estuarine and fresh waters to open Gulf beaches and nearshore waters during the summer spawning season.

80-001242 Hayman, R. A.; A. V. Tyler and R. L. Demory. COMPARISON OF COHORT ANALYSIS AND CATCH PER UNIT EFFORT FOR DOVER SOLE AND ENGLISH SOLE. *Trans. Am. Fish. Soc.* 109(1):35-53. Jan. 1980. SFA 25(2)
[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331]

80-001243 Helle, J. H. INFLUENCE OF MARINE ENVIRONMENT ON AGE AND SIZE AT MATURITY, GROWTH, AND ABUNDANCE OF CHUM SALMON, *ONCORHYNCHUS KETA* (WALBAUM), FROM OLSEN CREEK, PRINCE WILLIAM SOUND, ALASKA. *Ph. D. dissertation, Oreg. State Univ.* 129p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2504. Dec. 1979. SFA 25(2)

80-001244 Ita, E. O. CONTRIBUTION TO THE DYNAMICS OF MEAN-SIZE STATISTICS IN A CHANGING FISHERY: I. FAMILY CITHARINIDAE IN KAINJI LAKE, NIGERIA. *Hydrobiologia* 68(3):269-277. 16 Feb. 1980. SFA 25(2)
[Kainji Lake Res. Inst., P.M.B. 666, New Brussa, Nigeria] A model on 'The dynamics of mean-size statistics in a changing fishery' proposed by Henderson (FAO) was tested using the Kainji Lake experimental gill-net data collected between 1969 and 1977. The results revealed distinct trends in mean weight and population abundance (catch/effort) for members of the family Citharinidae. Simultaneous plots of mean weight against $\log_{10}$ of population abundance allowed the 'diagnosis' of the causes of change. Changes were attributed to the effects of fishing mortality, intensive recruitment into the fishery and change in selectivity coupled with the effect of growth. The pattern of change depicted for *Citharinus citharus* Geoffroy St. Hilaire revealed a three yearly cycle of intensive recruitment. The regression of mean weight on mean length for *C. citharus* gave a linear relationship thus facilitating the extrapolation of the mean weight values to the mean lengths of fish caught in the different meshes of gill-nets. The conversions permitted the selection of suitable mesh nets for capturing fish at appropriate levels of mean weights in order to safeguard the survival of sexually mature adults for an intensive spawning cycle.

80-001245 Kowtal, G. V. STUDIES ON THE JUVENILE FISH STOCK OF CHILKA LAKE. *Indian J. Fish.* 23(1/2):31-40. 1976. SFA 25(2)
[Cent. Inland Fish. Res. Substn., Cuttack, India]

80-001246 Krishnamoorthi, B. A NOTE ON MORTALITY RATES AND YIELD PER RECRUIT IN *NEMIPTERUS JAPONICUS* (BLOCH). *Indian J. Fish.* 23(1/2):252-256. 1976. SFA 25(2)
[Waltair Res. Cent. C.M.F.R. Inst., Waltair, Visakhapatnam 3, India] Both the yield per recruit in weight (Y_W/R) and in numbers (Y_N/R) in *Nemipterus japonicus* (Bloch) increase with increased fishing mortality i.e., with increased fishing mortality, yield increases to an asymptote. Since the rate of exploitation works to about 3% only, it seems reasonable to remark that the stocks of *N. japonicus* are very much underexploited.

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80-001247 Lehtonen, H. STOCK ASSESSMENT OF PIKE-PERCH (*STIZOSTEDION LUCIOPERCA* L.) IN THE HELSINKI SEA AREA. *Finn. Fish. Res.* 3:1-12. 1979. SFA 25(2)

[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland] Of 2,075 tagged pike-perch 361 were recaptured and reported. The most distant recovery was made 300 km from the place of release, but the fish were usually recaptured within a distance of 10 km. The pike-perch spawn in inlets and winter in deeper waters between islands and near the open sea. In the Helsinki sea area there are three separate pike-perch populations. The total annual mortality rate was estimated at 0.78 for pike-perch measuring 31 cm and more. The natural mortality rate was estimated to be 0.05-0.15. Growth takes place mainly between late July and early October. In 1970-1971 the catch per 1,000 recruits (age 3 years) was 190-260 kg and the equilibrium yield was nearly reached. Since then the fishing effort has more than doubled and the equilibrium yield may have been passed. The average density of age 3 and older pike-perch was in summer 26-42 ind./ha and the average biomass 8.4-12.6 kg/ha.

80-001248 MacCall, A. D. POPULATION ESTIMATES FOR THE WANING YEARS OF THE PACIFIC SARDINE FISHERY. *Calif. Coop. Oceanic Fish. Invest.* 20:72-82. Oct. 1979. SFA 25(2)

[Calif. Dep. Fish Game, Southwest Fish. Cent., La Jolla 92038] New sardine (*Sardinops sagax caerulea*) population estimates for the period 1945 to 1965 are calculated based on a cohort analysis of aged landings data. Three-year-old fish were incompletely recruited after 1953, requiring assumption of age 4 as age of full recruitment. The assumed natural mortality rate (*M*) was maintained at 0.4 for the entire time series. Landings from waters south of Punta Baja, Baja California, were excluded from the analysis. Biomass estimates are smaller than those previously given but agree well with independent indices of abundance. The new ratio of sardine spawning biomass to CalCOFI sardine larva census is double the previous value. A 95% confidence interval ranges from one quarter to quadruple the estimated biomass. The stock-recruitment relationship shows no curvature for the entire time series taken as a whole, and a purely functional description of the relationship is that mean recruitment only slightly exceeds potential replacement of spawners at all levels of abundance. Population simulations demonstrate this lack of resilience to fishing. Maximum constant fishing pressure that the population could have sustained was about 22% per year (F = 0.25). Maximum sustainable yield was about 250,000 tons/year, which is far below previous estimates.

80-001249 Pelzman, R. J.; S. A. Rapp and R. R. Rawstron. MORTALITY AND SURVIVAL OF TAGGED SMALLMOUTH BASS, *MICROPTERUS DOLOMIEUI* AT MERLE COLLINS RESERVOIR, CALIFORNIA. *Calif. Fish Game* 66(1):35-39. Jan. 1980. SFA 25(2)

[Calif. Dep. Fish Game, Inland Fish. Br., 1701 Nimbus Rd., Rancho Cordova 95670] A tagging study initiated in 1976 at Merle Collins Reservoir, Yuba County, provided estimated rates of exploitation (0.66), expectation of death from natural causes (0.18), and survival (0.16) for smallmouth bass, *Micropterus dolomieui*, comparable to rates recorded for largemouth bass, *M. salmoides*, at California reservoirs. A 305-mm (12.0-inch) minimum size limit on largemouth bass apparently protected smallmouth under the size limit and was probably instrumental in maintaining an attractive smallmouth bass catch despite high exploitation. Loss of shoreline habitat in the form of trees and brush has led to a decline in largemouth bass abundance and subsequent smallmouth bass dominance of bass catches at several older reservoirs.

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80-001250 Radovich, J. and A. D. MacCall. A MANAGEMENT MODEL FOR THE CENTRAL STOCK OF THE NORTHERN ANCHOVY, *ENGRAULIS MORDAX*. *Calif. Coop. Oceanic Fish. Invest.* 20:83-88. Oct. 1979. SFA 25(2)

[Calif. Dep. Fish Game, Sacramento 95814] The average growth of the northern anchovy central subpopulation between the years 1951 and 1975, as measured by CalCOFI egg and larva surveys, can be empirically described by a logistic growth curve. The asymptotic maximum population size, or spawning biomass, is 4 million short tons, and the intrinsic rate of increase is 0.36. A maximum average growth rate of 360,000 short tons/year occurs at a spawning biomass of 2 million tons. If the population were maintained at 2 million tons by harvesting surplus production, an estimated 450,000 short tons/year could be harvested. The difference between yield and population growth rate is due to the competing risk of death between fishing mortality and natural mortality. This estimate of potential productivity is smaller than previous estimates, but is better founded.

80-001251 Selifonov, M. M. THE OCEAN CATCH OF SEXUALLY IMMATURE SOCKEYE SALMON, *ONCORHYNCHUS NERKA*, OF THE OZERNAYA RIVER POPULATION. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):839-843. 1978. SFA 25(2)

[KOTINRO, Petropavlovsk-Kamchatskiy, USSR] Data on catches of immature sockeye salmon, *Oncorhynchus nerka*, from Ozernaya River population in the period 1962-1972 was analyzed. The catch was determined by an analysis of biomass dynamics. The increase in biomass (growth) exceeds the loss from natural mortality in the sea. Poor catches are increasing as the exploitation rates of sexually mature fish increases. The catch of immature fish causes a reduction in the abundance of the population. It is concluded that fishing for immature Ozernaya River sockeye in the sea is irrational.

80-001252 Simonova, N. A. POPULATION DYNAMICS OF KAMCHATKA RIVER SOCKEYE SALMON, *ONCORHYNCHUS NERKA*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):722-733. 1978. SFA 25(2)

[KOTINRO, Petropavlovsk-Kamchatskiy, USSR] The abundance of year-classes and the biological indicators of Kamchatka River sockeye salmon depends not only on the abundance of the spawning population and conditions of reproduction and foraging in fresh water, but also on conditions in the sea: on the number of smolts and the abundance of simultaneously foraging sockeye populations from other waters.

80-001253 Sjöblom, V. and R. Parmanne. ABUNDANCE OF BALTIC HERRING OFF THE COAST OF FINLAND IN 1956-78 ACCORDING TO EXPLORATORY FISHING WITH A PELAGIC TRAWL. *Int. Counc. Explor. Sea.* C.M. 1979/J:21. 10p. 1979. In Finnish with English summ. SFA 25(2)

[Univ. Helsinki, Dep. Limnol., Viikki, SF-00710 Helsinki 71, Finland] The density of the Baltic herring stock is almost the same in all the sea areas around Finland. In the Gulf of Finland the density in the 1970's has been only half of that in the 1960's. Judged by the abundance of juvenile herring, propagation in the northern part of the Bothnian Sea and in the Bothnian Bay is lower than off the southern Finnish coast. There have been no changes in the level of propagation during the observation period.

80-001254 Sjöblom, V. and R. Parmanne. ABUNDANCE OF SPRAT EGGS AND LARVAE IN THE NORTHERN BALTIC IN 1978. *Int. Counc. Explor. Sea.* C.M. 1979/J:20. 5p. 1979. In Finnish with English summ. SFA 25(2)

[Univ. Helsinki, Dep. Limnol., Viikki, SF-00710 Helsinki 71, Finland]

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80-001255 Sjöblom, V. and R. Parmanne. THE YEAR CLASS STRENGTH OF SPRING SPAWNING BALTIC HERRING ESTIMATED FROM ABUNDANCE OF LARVAE IN THE SEAS AROUND FINLAND IN 1974-79. *Int. Counc. Explor. Sea.* C.M. 1979/J:19. 9p. 1979. SFA 25(2)
[Univ. Helsinki, Dep. Limnol., Viikki, SF-00710 Helsinki 71, Finland]

80-001256 Sjöblom, V. and R. Parmanne. ABUNDANCE OF SPRAT OFF THE COAST OF FINLAND IN 1956-68 AND 1975-78 ACCORDING TO EXPLORATORY FISHING WITH A PELAGIC TRAWL. *Int. Counc. Explor. Sea.* C.M. 1979/J:18. 9p. 1979. In Finnish with English summ. SFA 25(2)
[Univ. Helsinki, Dep. Limnol., Viikki, SF-00710 Helsinki 71, Finland]

80-001257 Wagner, D. S.; J. B. Averill and M. C. Miller. VARIATION IN LARVAL DENSITIES IN THE OHIO RIVER, MELDAHL POOL. *Ohio J. Sci.* 80:94. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. Cincinnati, Cincinnati, OH 45421] The larval fish population in the Ohio River was sampled weekly at six sites, April to August, 1976 to 1978, near Maysville, Kentucky. Data on the pattern and length of appearance of fish species coincides with the known life histories of these species. Total larval fish densities in 1976 were greater than in 1978 and 1977 respectively. In 1976, the highest mean density was 1382 larvae/100 m^3 on June 11; 196/100 m^3 on June 27, 1978; and 121/100 m^3 on June 17, 1977. These highest density dates coincide with the first sample date where water temperature reached 25C or greater. The taxonomic composition of samples differed between 1976 and 1977. In 1976, the earliest collections were predominantly suckers (Catastomidae), comprising 76.7% of identifiable larvae from a total abundance of 15.4 larvae/100 m^3. On all succeeding dates, over 80% of identifiable larvae were clupeids and/or minnows. Suckers were more predominant in 1977. In contrast, clupeid densities dropped a thousandful from 1976 to 1977. A model for estimating the total larval fish population in the area will be discussed.

80-001258 Wiley, R. W. and D. J. Dufek. STANDING CROP OF TROUT IN THE FONTENELLE TAILWATER OF THE GREEN RIVER. *Trans. Am. Fish. Soc.* 109(2):168-175. Mar. 1980. SFA 25(2)
[Rt. 2, Box 25, Laramie, WY 82070]

80-001259 Woodrum, J. E. COMPARISON OF ROTENONE AND ELECTROFISHING POPULATION ESTIMATES TO LAKE DRAINING. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:634-638. 1978[1979]. SFA 25(2)
[W.Va. Dep. Nat. Resour., P.O. Box 67, Elkins 26241] The results from cove rotenone sampling and electrofishing population estimates for largemouth bass (*Micropterus salmoides*) were compared with the total largemouth bass populations obtained through draining of Sherwood Lake, a 67 ha impoundment in southeastern West Virginia. Rotenone samples over-estimated all size groups of largemouth bass (fingerling, intermediate and harvestable) both in number and weight. Electrofishing (Schnabel population estimates) more closely represented the numbers and weight of largemouth bass recovered at the lake draining. Schnabel estimates were 10,096 (7,870-14,079) while total draining produced 9,224 bass. Electrofishing standing crop was estimated at 151 fish/ha and 8.3 kg/ha while draining totals were 138 fish/ha and 9.9 kg/ha.

80-001260 Yeager, D. M. and M. J. Van Den Avyle. RATES OF ANGLER EXPLOITATION OF LARGEMOUTH, SMALLMOUTH, AND SPOTTED BASS IN CENTER HILL RESERVOIR, TENNESSEE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl.*

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80-001260 CONTINUED *Agencies* 32:449-458. 1978[1979]. SFA 25(2)
[Tenn. Coop. Fish. Res. Unit, Tenn. Tech. Univ., Cookeville 38501] A tag-and-reward procedure was used to estimate exploitation rates of black bass (*Micropterus* sp.) during 1975 and 1976 in Center Hill Reservoir, Tennessee. Returns of reward tags by anglers indicated annual exploitation rates of 13.3 (22.2%) for largemouth (*M. salmoides*), 12.9 (15.6%) for smallmouth (*M. dolomieui*) and 14.8 (18.5%) for spotted bass (*M. punctulatus*). Within each year, exploitation rates were not significantly different between species or size groups. Rates were lower in 1976 than in 1975 for all species, but the difference was significant only for largemouth bass. In 1975, when tag reward values were publicly announced, most data suggested that tags with no reward value were returned at rates lower than those observed for reward tags. In 1976, when a random-reward procedure was used, differential rates of return were not detected. Monthly graphs of recaptures (R) expressed as a percentage of the total catch (C) from creel survey data indicated that tag loss and (or) differential mortality caused exploitation estimates based on 12 months of returns to be too low. If R/C ratios had remained at levels similar to those observed during the first 2 or 3 months following tagging, rates of about 30% would have been observed for all species in both years. Comparisons of observed and adjusted exploitation rates with estimated rates of natural mortality indicated that overharvest of black bass is probably not occurring in Center Hill Reservoir.

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80-001261 Alldridge, N. A. and Andrew M. White. SPAWNING SITE PREFERENCES FOR NORTHERN PIKE (*ESOX LUCIUS*) IN A NEW YORK MARSH WITH WIDELY FLUCTUATING WATER LEVELS. *Ohio J. Sci.* 80:13. 1980. Abstract only. SFA 25(2)
[Case-Western Reserve Univ., Cleveland, OH] Numerous literature accounts of the spawning of Northern Pike indicate that the species spawns over substrates of flooded terrestrial grasses, early in spring. In the spring of 1979 we studied an area in Conesus Lake, New York in which water levels of the marsh fluctuated widely during the spawning season. Available substrates for spawning included flooded areas of Canary Grass, Rice Cut Grass, Cattail, leaf litter, pondweeds, Polygonums, Buttonbush, old field forbs, sawdust and brushpiles and bulrushes. More than 140 observations of spawning indicated that preferences were correlated with depth, not vegetation type and that as depths changed in the marsh, substrates utilized shifted accordingly. Further, heavy or thick types of vegetation (Cattail, Buttonbush, brush) were consistantly avoided. These results indicate that the spawning of the Northern Pike occurs in open water areas, over any available vegetation so long as depths were within the range of approximately 6 to 24 inches, (12.06 ± 3.01 inches) and Cattail, brush or bushes were absent. Spawning occurred consistantly at temperatures above 5.5 C and on days when the area was iced spawning was delayed until late afternoon.

80-001262 Artyukhin, Ye. N.; A. D. Sukhoparova and L. G. Fimukhina. THE GONADS OF THE STURGEON, *ACIPENSER GULDENSTADTI*, IN THE ZONE BELOW THE DAM OF THE VOLGOGRAD WATER ENGINEERING SYSTEM. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):912-923. 1978. SFA 25(2)
[Cent. Lab. Reprod. Fish Stocks, Glavrybvod, Nizhnevolzhrybvod, USSR] The results of observations on the state of the gonads of the mature sturgeon, *Acipenser guldenstadti*, from the area below the dam of the Volgograd hydraulic engineering system in different seasons are presented. The dynamics of changes in the state of the gonads is discussed in relation to the nature

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80-001262 CONTINUED of the migration and the time of spawning. Descriptions are given of impaired gametogenesis in some of the fish both below the dam and in the reservoir, to which the fish are transferred by a fish lift.

80-001263 Colman, J. A. SPAWNING OF THE SPRAT, *SPRATTUS ANTIPODUM* (HECTOR), ROUND THE SOUTH ISLAND OF NEW ZEALAND. *N.Z. J. Mar. Freshwater Res.* 13(20):263-272. 1979. SFA 25(2)

[Fish. Res. Div., Minist. Agric. Fish., P.O. Box 19-062, Wellington, New Zealand] The distribution of eggs of the sprat, *Sprattus antipodum* (Hector), in the plankton of coastal waters round the South Island of New Zealand during winter and spring of 1973, 1974, and 1975 is described from the results of plankton surveys with a high-speed sampler. The principal spawning grounds were in the Canterbury Bight, with other spawning areas off the Otago coast and the West Coast. The stock of sprats in the Canterbury Bight was estimated to be at least 60,000 t.

80-001264 Fischer, E. A. MATING SYSTEM AND SIMULTANEOUS HERMAPHRODITISM IN THE CORAL REEF FISH, *HYPOPLECTRUS NIGRICANS* (SERRANIDAE), WITH A DISCUSSION OF THE SYSTEMATIC STATUS OF THE SPECIES IN THE GENUS *HYPOPLECTRUS*. *Ph.D. dissertation, Univ. Calif. (Berkeley)* 161p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(7):3037. Jan. 1980. SFA 25(2)

80-001265 Glebe, B. D.; T. D. Appy and R. L. Saunders. VARIATION IN ATLANTIC SALMON (*SALMO SALAR*) REPRODUCTIVE TRAITS AND THEIR IMPLICATIONS IN BREEDING PROGRAMS. *N. Am. Salmon Res. Cent. Rep.* No. 4. 11p. 1979. SFA 25(2)

[Huntsman Mar. Lab., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Analysis of variance of inter and intra-strain crosses of Atlantic salmon from four New Brunswick rivers indicated a strong maternal influence on progeny size. The reproductive traits, egg size and energy content and fecundity, were investigated as possible causes of this effect. The lack of a significant difference ($p>.75$) in energy content of unit weights of ova from each stock suggested similar proximate compositions. However, significant differences in egg diameter ($p<.01$) existed as did a significant correlation ($p<.01$) between egg size and progeny mean length. No correlation between egg size and juvenile survival was detected. The calculated energy content per ovum ranged from 1066 J (SD=215) for the Magaguadavic stock to 1576 J (SD=140) for salmon of Rocky Brook origin. Increased egg size may have contributed to a significant depression in fecundity of Rocky Brook females. The importance of understanding the relative influence of maternal effects associated with reproductive traits in salmon breeding studies is discussed.

80-001266 Goldberg, S. R. SEASONAL SPAWNING CYCLES OF TWO MARINE COTTID FISHES, *CHITONOTUS PUGETENSIS* AND *ICELINUS QUADRICERIATUS* FROM SOUTHERN CALIFORNIA. *Bull. Mar. Sci.* 30(1):131-135. Jan. 1980. SFA 25(2)

[Dep. Biol., Whittier Coll., Whittier, CA 90608] Spawning cycles are described for two marine cottids from southern California. Histological analyses of seasonal collections indicated both species had prolonged spawning periods with maximum spawning activity from late winter to early spring. Spawning declined in summer, however, small numbers of females in spawning condition were collected in fall and early winter indicating the

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80-001266 CONTINUED likelihood of some year-round spawning. It is postulated that both species produce at least three egg clutches per year. The winter peak spawning activity began earlier in 1978 than it did in 1977.

80-001267 Gubanov, Ye. P. THE REPRODUCTION OF SOME SPECIES OF PELAGIC SHARKS FROM THE EQUATORIAL ZONE OF THE INDIAN OCEAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):781-792. 1978. SFA 25(2)
[AzCherNIRO, Kerch, USSR]

80-001268 Hancock, R. S. THE ANNUAL CYCLE OF INTRAOVARIAN EGG SIZE AND FECUNDITY OF THE BARBEL *BARBUS BARBUS* IN THE RIVER SEVERN. *Freshwater Biol.* 9(6):535-542. Dec. 1979. SFA 25(2)
[Dep. Fish., Univ. Technol., P.O. Box 793, Lae, Papua New Guinea] The annual cycle of intraovarian egg size in 124 mature barbel caught during a 3-year period was investigated. Storage methods, subsampling and measuring procedures were assessed and found to be reliable. Estimates of fecundity were made on thirty-two barbel containing developing ripening eggs. A new egg separation and counting technique was used modified from the volumetric ratio method described by Bagenal & Braum. Fecundity estimates were found to be accurate by comparison with manual counts. Barbel ovaries contained two egg groups throughout the year. A third large, ripening egg group developed prior to spawning. The diameter of the ripening eggs, measured in arbitrary optical units, was significantly correlated with fork length. Large fish spawned bigger eggs than small fish. Fecundity was logarithmically related to fork length and ovary weight and linearly related to somatic weight. The mean diameter of the ripening intraovarian egg group was also logarithmically related to ovary weight. Heavier ovaries contained proportionally fewer, but larger, ripening eggs than small ovaries.

80-001269 Hayashi, Y. [STUDIES ON THE MATURITY AND THE SPAWNING OF THE RED TILEFISH IN THE EAST CHINA SEA--II. SPAWNING PATTERN ESTIMATED FROM THE MONTHLY CHANGES OF OVARIAN EGG DIAMETERS.] *Bull. Jpn. Soc. Sci. Fish.* 45(12):1475-1479. Dec. 1979. In Japanese with English summ. SFA 25(2)
[Yamaguchi Pref. Gachai Fish. Exp. Stn., Senzaki, Nagato 759-41, Japan] The present paper aimed to make clear the spawning pattern of the red tilefish, *Brachiostegus japonicus japonicus*, by investigating the diameter distribution curves of their ovarian eggs. Samples of 273 ovaries were collected from the fish landed by bottom long-liners in the East China Sea during the period from April 1974 to March 1976. The results obtained were summarized as follows; 1) The ovaries were classified into eight types of maturation stage by analyzing the pattern of distribution curves of ovarian egg diameters. 2) Judging from the frequency distribution for each type in every month, it was concluded that the spawning of larger females (BL≥240 mm) last for five months from June to October. But spawning in September was not so active. 3) In the case of smaller females (BL<240 mm), it was estimated that most of them spawned in June, July and October, a few of them in only October and the remainder in June and July.

80-001270 Honda, H. FEMALE SEX PHEROMONE OF THE AYU, *PLECOGLOSSUS ALTIVELIS*, INVOLVED IN COURTSHIP BEHAVIOUR. *Bull. Jpn. Soc. Sci. Fish.* 45(11):1375-1380. Nov. 1979. SFA 25(2)
[Cent. Res. Inst. Elec. Power Industry, Abiko, Chiba 270-11, Japan] This report deals with the courtship behaviour and the presence of a female sex pheromone of the Ayu, *Plecoglossus altivelis*. Increased ventilatory frequencies and fin display reactions in the male Ayu were elicited by the water sample inclusive of post-ovulatory females. It was noticed that the males were able to discriminate post-ovulatory females from pre-ovulatory

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80-001270 CONTINUED females without actually sighting the female. Some highlighted aspects derived from these experiments are listed as follows: 1. Post-ovulatory females released a female sex pheromone, which males detect by olfaction. 2. The female sex pheromone, produced in the ovaries of post-ovulatory females, is secreted through the urogenital papilla. 3. The female sex pheromone was found to be a water-ether soluble basic substance, having an Rf value of 0.43 on the thin layer chromatogram (silica gel) with a chyclohexane-ethyl alcohol (4:1) solvent. 4. The female sex pheromone from post-ovulatory females played the role of first trigger, inducing a series of courtship behaviour of the Ayu.

80-001271 Hopkins, C. L. REPRODUCTION IN *GALAXIAS FASCIATUS* GRAY (SALMONIFORMES: GALAXIIDAE). *N.Z. J. Mar. Freshwater Res.* 13(2):225-230. 1979. SFA 25(2)

[Fish. Res. Div., Minist. Agric. Fish., Private Bag, Christchurch, New Zealand] A study of the reproductive cycle was made on *Galaxias fasciatus* Gray from streams on Banks Peninsula, South Island, New Zealand. There was no spawning migration; adults remained in the usual adult habitat to breed. The course of gonad maturation showed that spawning occurred in the autumn, from end of April to mid-June. Most males matured at 2 years of age and most females at 4 years old. Egg numbers in the females varied from 3,800 to 23,600. Males were predominant in age groups 1-4, females in the older age groups. Amongst fish of potential breeding age there was an excess of males. Circumstantial evidence suggested that eggs were laid among piles of water-logged debris lodged in pools and backwaters. The larvae, which are briefly described, probably hatch during floods to be swept quickly downstream to the sea.

80-001272 Hunter, J. R. and S. R. Goldberg. SPAWNING INCIDENCE AND BATCH FECUNDITY IN NORTHERN ANCHOVY, *ENGRAULIS MORDAX*. *NOAA Fish. Bull.* 77(3):641-652. July 1979. SFA 25(2)

[NMFS, P.O. Box 271, La Jolla, CA 92038] Histological criteria were developed to age postovulatory follicles from examination of laboratory-spawned northern anchovy and used to estimate the frequency of spawning of natural populations. One-day-old, postovulatory follicles were the preferred estimator of spawning frequency; 48 hours after spawning postovulatory follicles could not be consistently identified because of their rapid degeneration; and the occurrence of postovulatory follicles less than 24 hours old was affected by hour of sampling and sexual composition of the school. The nightly spawning incidence was estimated to be 16±4% of the northern anchovy population in February and 12% in March. Thus, females spawned about every 6-8 days during the peak of the breeding season. The rate of oocyte development corresponded with this reproductive rate, indicating that a new mode of yoked oocytes matured about once a week. Nearly all eggs in the most advanced mode in the ovary were spawned in one night and the number of eggs spawned was estimated to be 389±59 eggs/g of female (ovary-free wet weight). The high spawning frequency and the prolonged breeding season of the northern anchovy indicate that total fecundity may be limited by food availability and energy reserves.

80-001273 Lazurus, S. ON THE OCCURRENCE OF OILSARDINE IN THE SPAWNING STAGE OFF VIZHINJAM. *Indian J. Fish.* 23(1/2):249-252. 1976. SFA 25(2)

[Vizhinjam Res. Cent. C.M.F.R. Inst., Vizhinjam, India] The occurrence of ripe and spawning oilsardine, *Sardinella longiceps* Val. off Vizhinjam is reported for the first time. Ova-diameter studies reveal a bimodal distribution of ova and fecunity estimates of the primary and secondary modes were about 46,000 and 88,000 ova respectively.

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80-001274 Malmqvist, B. THE SPAWNING MIGRATION OF THE BROOK LAMPREY, *LAMPETRA PLANERI* BLOCH, IN A SOUTH SWEDISH STREAM. *J. Fish Biol.* 16(1):105-114. Jan. 1980. SFA 25(2)

[Dep. Anim. Ecol., Ecol. Bldg., S-223 62 Lund, Sweden] The spawning migration of brook lampreys (*Lampetra planeri*, Bloch) was investigated in a South Swedish lake and stream system for two consecutive years. The nightly variations were analysed by a multiple regression technique. In one of the seasons, characterized by frequent rain storms, water level was the most important factor explaining 60% of the observed variation in migration. In the following year, when the migration period was unusually dry, temperature and on-shore winds at the mouth of the stream were the most influential environmental variables explaining 50% of the observed changes in behaviour. When data were combined for the two years only temperature showed a significant influence. The critical temperature for the onset of migration was estimated to be 7.5°C. Size distributions and sex ratios of the migrating lampreys, which are semelparous, indicated that the age distribution was complex and that females were older than males. Migration was essentially nocturnal, but late in the season day migration was also observed. A marking experiment resulted in few recaptures probably because of high predation and/or orientation difficulties.

80-001275 Marliave, J. B. SPAWNING AND YOLK-SAC LARVAE OF THE AGONID FISH SPECIES, *AGONOMALUS MOZINOI* WILIMOVSKY AND WILSON. *Syesis* 11:285-286. 1978. SFA 25(2)

[Vancouver Publ. Aquarium, P.O. Box 3232, Vancouver, BC V6B 3X8, Canada]

80-001276 Mathur, D.; P. L. McCreight and G. A. Nardacci. VARIATIONS IN FECUNDITY OF WHITE CRAPPIE IN CONOWINGO POND, PENNSYLVANIA. *Trans. Am. Fish. Soc.* 108(6):548-554. Nov. 1979. SFA 25(2)

[Radiation Manage. Corp., Muddy Run Ecol. Lab., P.O. Box 10, Drumore, PA 17518]

80-001277 McCarley, H. and L. G. Hill. REPRODUCTION OF *LEPISOSTEUS SPATULA* (LEPISOSTEIDAE) IN LAKE TEXOMA. *Southwest. Nat.* 24(4):694-695. 10 Dec. 1979. SFA 25(2)

[Dep. Biol., Austin Coll., Sherman, TX 75090]

80-001278 Misitano, D. A. A RECORD OF INTERNAL FERTILIZATION IN THE ROUGHBACK SCULPIN *CHITINOTUS PUGETENSIS* WITH DESCRIPTIVE NOTES OF THEIR EARLY LARVAE. *Copeia* 1980(1):162-165. 1 Feb. 1980. SFA 25(2)

[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-001279 Mueller, G. EFFECTS OF RECREATIONAL RIVER TRAFFIC ON NEST DEFENSE BY LONGEAR SUNFISH. *Trans. Am. Fish. Soc.* 109(2):248-251. Mar. 1980. SFA 25(2)

[Water Power Serv., Div. Plan., Box 427, Boulder City, NV 89005]

80-001280 Olsen, E. K. DISTRIBUTION OF PELAGIC YELLOW PERCH AND WALLEYE FRY IN TWO NORTHERN WISCONSIN LAKES. *Ph.D. dissertation, Univ. Wis.* 100p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2563. Dec. 1979. SFA 25(2)

Yellow perch and walleye fry migrated upward in Escanaba Lake soon after light intensities began to increase before dawn. From late May through early July they were more abundant at 1 m when light intensities (at 1 m) were between .1 and .05 lux (~0500 CST). As light intensity continued to increase, the fry again moved deeper and when light intensities were between

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80-001280 CONTINUED $10^{3.5}$ and 10^{4} lux, they were more abundant at 3 m, where they generally remained until evening. Fry tended to be deeper on afternoons when surface waters were more turbulent. In early evening (~1800 CST) when light intensity was ~10^{4} lux, both species were more abundant at 3 m, but migrated upward at dusk to become more abundant at 1 m when light intensities were between 10^{2} and 1 lux (2000-2100 CST). At night, downward movement usually occurred when light intensity was lowest (< .15 lux). Once, under a full moon, yellow perch and walleye concentrated at 1 m. The morning and evening upward movement of fry may have lengthened the period when yellow perch and walleye were able to perceive prey. The morning descent placed fry in midwater where zooplankton was at maximum abundance. Temperature gradients were usually slight in both lakes and a thermal strategy of vertical migration is unlikely. In the laboratory, walleye (~12 mm in length) and yellow perch (~10 mm in length) fry were positively phototactic at .0001 lux and .001 lux, respectively, and the walleye were negatively phototactic at 10^{5} lux. Walleye fry ~32 mm in length were negatively phototactic at 3 lux. Perch fry were never significantly photonegative, even at intensities > 10^{5} lux. Walleye fry in Little John Lake, attracted to the light of a gas lantern at night, were most abundant over the deeper parts of the lake and absent in water Φ2 m deep. Yellow perch fry in Escanaba Lake were also abundant over deep water, but were not uncommon in more inshore regions.--From abstr.

80-001281 Pavlov, D. A. THE DEVELOPMENT OF THE ANADROMOUS KAMCHATKA TROUT, *SALMO MYKISS*, AND ITS POSITION IN THE CLASSIFICATION OF *SALMO*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):923-936. 1978. SFA 25(2)
[Dep. Ichthyol., Moscow Univ., USSR]

80-001282 Rinne, J. N. SPAWNING HABITAT AND BEHAVIOR OF GILA TROUT, A RARE SALMONID OF THE SOUTHWESTERN UNITED STATES. *Trans. Am. Fish. Soc.* 109(1):83-91. Jan. 1980. SFA 25(2)
[Rocky Mountain For. Range Exp. Stn., Ariz. State Univ., Tempe]

80-001283 Scott, A. P.; M. Htun-Han; V. J. Bye; J. R. C. Springate and S. M. Baynes. EFFECT OF PHOTOPERIOD ON GONADAL MATURATION OF FEMALE DAB (*LIMANDA LIMANDA* L.). *Gen. Comp. Endocrinol.* 40(3):336. Mar. 1980. Abstract only. SFA 25(2)
[Fish. Lab., Lowestoft, NR33 0HT, England] Several experiments have been carried out to assess the effect of photoperiod manipulation on the development of the ovaries in dab (*Limanda limanda* L.). An early observation by Htun-Han (unpublished results) was that dabs subjected to a 4L:8D:4L:8D photoperiod from July reached full maturity in October, 6 months ahead of the normal spawning season. We attempted to repeat this observation (with two groups of eight female dabs), but started the experimental photoperiod in March. Other groups of fish were exposed to a normal photoperiod, an accelerated "6-month cycle," and 16L:8D (thought to be inhibitory). All fish were bled monthly, and plasmas assayed for oestradiol, testosterone, and cortisol. Gonadal maturation did not appear to be influenced by the experimental photoperiods. Levels of oestradiol and testosterone started to rise in all fish in October/September and peaked in January/February. By March, all surviving fish had ovulated. Further experiments are planned to test whether the time of year at which dabs are subjected to experimental photoperiods is an important factor in inducing early maturation.

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80-001284 Smith, D. G. EARLY LARVAE OF THE TARPON, *MEGALOPS ATLANTICA* VALENCIENNES (PISCES: ELOPIDAE), WITH NOTES ON SPAWNING IN THE GULF OF MEXICO AND THE YUCATAN CHANNEL. *Bull. Mar. Sci.* 30(1):136-141. Jan. 1980. SFA 25(2)

[Mar. Biomed. Inst., Univ. Tex. Med. Br., Galveston 77550] A description is given of the early larval stages of the tarpon, emphasizing the preflexion and flexion stages, up to about 12 mm standard length. A 5.7 mm specimen retained part of the yold sac and is the smallest tarpon larva known. At a length of about 10-11 mm flexion of the notochord occurs and dorsal and anal pterygiophores appear. Hypurals and caudal-fin rays develop at flexion; dorsal- and anal-fin rays appear somewhat later, at about 16 mm. Pelvic fins appear at about 21 mm. Maximum size before metamorphosis is about 28 mm SL. Spawning occurs in the spring and summer in the Yucatan Channel and the Gulf of Mexico. Spawning areas are located off Cozumel, off the west coast of Florida, and in the southwestern Gulf of Mexico. The duration of larval life is about 3 months.

80-001285 Sumpter, J. P. and J. M. Dodd. THE ANNUAL REPRODUCTIVE CYCLE OF THE FEMALE LESSER SPOTTED DOGFISH, *SCYLIORHINUS CANICULA* L., AND ITS ENDOCRINE CONTROL. *J. Fish Biol.* 687-695. Dec. 1979. SFA 25(2)

[Dep. Appl. Biol., Sch. Biol. Sci., Brunel Univ., Uxbridge, Middlesex UB8 3PH, England] Various aspects of the reproductive physiology of the female lesser spotted dogfish, *Scyliorhinus canicula* L., demonstrate marked annual cycles. Pituitary ventral lobe gonadotrophin content and plasma oestradiol and testosterone levels rise through the autumn as the ovary recrudesces and the percentage of fish bearing eggs in the oviducts increases. The pituitary gonadotrophin and plasma sex steroid levels remain elevated throughouth the winter but decrease during the spring, two months prior to a fall in both the gonadosomatic index (GSI) and the percentage of fish with eggs in their oviducts. The lowest gonadotrophin and sex steroid levels are found in early summer, again preceding the minimum GSI and rate of egg-laying by two or three months. Some of these cycles are pronounced, the pituitary gonadotrophin levels varying by more than 100-fold, and the oestradiol levels by more than 10-fold, throughout the year. It is concluded that the female dogfish has a very extended breeding season, though the peak frequency of egg-laying occurs in the winter and spring.

80-001286 Taubert, B. D. REPRODUCTION OF SHORTNOSE STURGEON (*ACIPENSER BREVIROSTRUM*) IN HOLYOKE POOL, CONNECTICUT RIVER, MASSACHUSETTS. *Copeia* 1980(1):114-117. 1 Feb. 1980. SFA 25(2)

[Ill. Nat. Hist. Surv., Aquatic Biol. Sect., Nat. Resour. Bldg., Urbana 61801] Shortnose sturgeon (*Acipenser brevirostrum*) spawned in the Holyoke Pool of the Connecticut River, Massachusetts, between 3 and 9 May 1977 and 10 and 12 May 1978. For 1977, water temperatures were 12-15 C, flows 304-481 m^3/s and velocities 37-56 cm/s, whereas those in 1978 were 10-12 C, 962-1,155m^3/s and 104 to 125 cm/s. Reproductively mature shortnose sturgeon and their larvae were only found in the upper, riverine end of Holyoke Pool where the substrate was mostly rubble. Shortnose sturgeon spawned first at 10 years and next at 17.9, and averaged 8.1 years between spawnings. Average weight and length at 10 years were 1,522 g and 579 mm FL and at 18 years, 3,166 and 747.

80-001287 Taylor, M. H. and L. DiMichele. OVARIAN CHANGES DURING THE LUNAR SPAWNING CYCLE OF *FUNDULUS HETEROCLITUS*. *Copeia* 1980(1):118-125. 1 Feb. 1980. SFA 25(2)

[Sch. Life Health Sci., Univ. Del., Newark 19711] The lunar spawning cycle of *Fundulus heterclitus* is accompanied by cyclic changes in ovarian hydration, egg size and follicular development. Maxima in these parameters

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

80-001287 CONTINUED occur in synchrony with the spring tide spawning peak. The pattern of ovarian maturation in this lunar or semilunar cycle is similar to that seen in the annual reproductive cycle of this species.

80-001288 Walsh, J. J.; T. E. Whitledge; W. E. Esaias; R. L. Smith; S. A. Huntsman; H. Santander and B. R. De Mendiola. THE SPAWNING HABITAT OF THE PERUVIAN ACHOVY, *ENGRAULIS RINGENS*. *Deep-Sea Res. A Oceanogr. Res. Pap.* 27(1):1-27. Jan. 1980. SFA 25(2)

[Oceanogr. Sci. Div., Brookhaven Natl. Lab., Upton, NY 11973] Individual larvae of the anchovy *Engraulis ringens* appear to survive better off the northern coast of Peru during the austral winter season when a motil algal food supply is available. Concentrations of the dinoflagellate food of the first feeding anchovy larvae may be reduced less often by wind events in the north than in the south. Under El Niño conditions, more of the adult anchovy are found south within a less favorable spawning habitat, in terms of dilution and food quality, where there is evidently less larval survival and subsequent recruitment to adult stocks. Increased mortality of the larvae during 1965, 1972, and 1976 El Niños and of the adults during the 20-year fishery has reduced the present stock to less than 20% of its biomass in times of peak yield. Such a change in food chain dynamics is reflected in transients of oxygen demand at the decadal scale of variability. Associated with an increase in zooplankton biomass and a decline of the anchovy fishery, the sardine species of the clupeid pair off Peru may also be increasing in number, implying that natural oscillations of clupeoids may be accelerated by overfishing.

80-001289 West, J. L. INTRAGRAVEL CHARACTERISTICS IN SOME WESTERN NORTH CAROLINA TROUT STREAMS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:625-633. 1978[1979]. SFA 25(2)

[Dep. Biol., West. Carolina Univ., Cullowhee, NC 28723] Characteristics of the intragravel environment of Southern Appalachian trout streams have not been studied. It was the purpose of this study to measure intragravel permeability, apparent velocity, temperature, dissolved oxygen, and bottom composition in areas that visually appeared suitable for trout spawning in 8 relatively undisturbed streams in the Pisgah National Forest of western North Carolina. Comparisons were made between these measurements and the development requirements of salmonid embryos. Two types of standpipes were used, the Mark VI groundwater standpipe and polyvinyl chloride (PVC) standpipes. The lowest mean intragravel dissolved oxygen was 3.2 mg/l. Dissolved oxygen measured by the Mark VI was consistently higher than when measured by the PVC standpipes which indicates that the Mark VI gives a better measure of the true intragravel dissolved oxygen than does the PVC standpipes. Between 1 November and 30 April, the period when trout embryos are in the gravel, none of the intragravel dissolved oxygen measurements taken with the Mark VI were below 6 mg/l. The data indicate that during the development period the dissolved oxygen was adequate for normal embryo survival. Between 1 November and 30 April the intragravel temperature varied from 0.5 to 11 C, temperatures considered to be adequate for trout spawning and embryo development. On a given sampling day the temperature varied no more than 0.5 C from one site to another and the mean intragravel temperature was about the same as the mean surface temperature. This indicates that most of the intragravel water is from surface origin rather than from ground sources. Mean apparent velocity varied from 3.5 to 42.7 cm/hour and mean permeability from 838 to 1,967 cm/hour. The mean percentage of the bottom sample between 0.84 and 3.36 mm varied from 8.8 to 28.2%. When the measurements are compared with requirements of salmonid embryos and alevins, the areas sampled are adequate for embryo survival. There is a possibility that the embryos are smaller than if intragravel dissolved oxygen and apparent velocity were higher. With the exception of 1 creek, it is probable that the amount of sand does not affect fry emergence.

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MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

80-001290 Sjöblom, V. and R. Parmanne. THE VERTICAL DISTRIBUTION OF BALTIC HERRING LARVAE (*CLUPEA HARENGUS* L.) IN THE GULF OF FINLAND. *Finn. Fish. Res.* 2:5-18. 1978. SFA 25(2)

[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland] The vertical distribution was investigated to determine the right sampling technique for assessing the abundance of larvae. Larvae were caught at all the sampling depths. In the early summer they were most abundant at 16 m. In the middle and end of the summer most larvae were found between depths of 0.2 and 2 m. The greatest catch of Baltic herring larvae was made in May in the evening at 16 m, 3.7 larvae/m^3. In the early summer the larvae were found in deep water by day and closer to the surface at night. Later in the summer the larvae were close to the surface by day and deeper at night. This difference was not explained by either the light or the size of the larvae. Vertical migration was, however, greater in the big than in the small larvae. In the middle of the summer the speed of the upward movement in the morning could be 0.4 cm/sec. Vertical distribution did not depend on the temperature of the water, and movement was not prevented by a temperature gradient of 4°C. Nor did vertical distribution appear to be affected by wind velocity. The occurrence of the Baltic herring larvae did not parallel the vertical distribution of zooplankton.--From abstr.

80-001291 Guillory, V. UTILIZATION OF AN INUNDATED FLOODPLAIN BY MISSISSIPPI RIVER FISHES. *Fla. Sci.* 42(4):222-228. 1979. SFA 25(2)

[Fla. Game Fresh Water Fish Comm., P.O. Box 1903, Eustis] The movement of main channel Mississippi River species on an adjoining floodplain was associated with flooding. Of 62 species collected, 24 were characteristic of the main channel and 15 occurred equally in both floodplain or main channel habitats. The presence of juveniles and/or spawning adults indicate that backwaters serve as important nursery areas for riverine fishes.

80-001292 Kelley, D. BASS POPULATIONS AND MOVEMENTS ON THE WEST COAST OF THE U.K. *J. Mar. Biol. Assoc. U.K.* 59(4):889-936. Nov. 1979. SFA 25(2)

[Old Farm, Trebetherick, Wadebridge, Cornwall, England]

80-001293 Kriete, W. H., Jr.; J. V. Merriner and H. M. Austin. MOVEMENT OF 1970 YEARCLASS STRIPED BASS BETWEEN VIRGINIA, NEW YORK, AND NEW ENGLAND. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:692-696. 1978[1979]. SFA 25(2)

[Va. Inst. Mar. Sci., Gloucester Point 23062] Striped bass (*Morone saxatilis*) were tagged in Virginia beginning in 1968. The 1970 yearclass of striped bass was tagged both in Virginia and New York in 1972. Fish tagged in Virginia were returned from New York to Maine while fish tagged in New York were returned from the Maryland portion of the Chesapeake Bay and the Potomac River. These data indicated that fish migrate from rivers in which they were spawned at different ages and that fish that migrate as 2 year olds remain together as a group until they are 3+ years. Therefore, within the Chesapeake Bay area there are distinct river populations at least until these populations are 3+ years old.

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

80-001294 Maeda, T.; T. Takahashi and M. Ueno. [ECOLOGICAL STUDIES ON THE ALASKA POLLACK IN THE ADJACENT WATERS OF THE FUNKA BAY, HOKKAIDO--III. SEASONAL VARIATIONS OF HYDROGRAPHIC CONDITIONS]. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1137-1142. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

80-001295 Sjöblom, V. and R. Parmanne. THE VERTICAL DISTRIBUTION OF BALTIC HERRING LARVAE (*CLUPEA HARENGUS* L.) IN THE GULF OF FINLAND. *Finn. Fish. Res.* 2:5-18. 1978. SFA 25(2)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O.B. 193, SF-00131, Helsinki 13, Finland] The vertical distribution was investigated to determine the right sampling technique for assessing the abundance of larvae. Sampling was done in May-August 1974 at Sipoonselkä in the Gulf of Finland, using the modified Gulf V sampler equipped with an auxiliary net for parallel zooplankton samples. At six times during the day and night, the sampler was towed at a speed of 4 knots for 20 minutes at depths of 0.2, 1, 2, 4, 8 and 16 m. In all 4699 Baltic herring larvae were caught. Larvae were caught at all the sampling depths. In the early summer they were most abundant at 16 m. In the middle and end of the summer most larvae were found between depths of 0.2 and 2 m. The greatest catch of Baltic herring larvae was made in May in the evening at 16 m, 3.7 larvae/m^3. In the early summer the larvae were found in deep water by day and closer to the surface at night. Later in the summer the larvae were close to the surface by day and deeper at night. This difference was not explained by either the light or the size of the larvae. Vertical migration was, however, greater in the big than in the small larvae. In the middle of the summer the speed of the upward movement in the morning could be 0.4 cm/sec. Vertical distribution did not depend on the temperature of the water, and movement was not prevented by a temperature gradient of 4°C. Nor did vertical distribution appear to be affected by wind velocity. The occurrence of the Baltic herring larvae did not parallel the vertical distribution of zooplankton.

80-001296 Tsukamoto, K.; S. Masuda; Y. Mori; and T. Kajihara. [DISPERSION OF AYU JUVENILES IN THE TSUBUSA RIVER--III. COMPARISON BETWEEN HATCHERY-REARED AYU AND WILD AYU.] *Bull. Jpn. Soc. Sci. Fish.* 45(11):1365-1370. In Japanese with English summ. SFA 25(2)
[Ocean Res. Inst., Univ. Tokyo, Nakano, Tokyo, Japan]

80-001297 Vigg, S. SEASONAL BENTHIC DISTRIBUTION OF ADULT FISH IN PYRAMID LAKE, NEVADA. *Calif. Fish Game* 66(1):49-58. Jan. 1980. SFA 25(2)
[Bioresources Center, Desert Research Inst., Reno, NV 89506] Relative densities of five fish species were determined at successive depth intervals during September, December, March, and June 1976-1977. For the total study period, an inverse relationship existed between depth and fish density for all species. Sacramento perch, *Archoplites interruptus*, were taken exclusively inshore. Inshore sampling stations accounted for 97% of the mean cui-ui, *Chasmistes cujus*, catch, and 73% of the Tahoe suckers, *Catostomus tahoensis*. Lahontan cutthroat trout, *Salmo clarki henshawi*, and tui chub, *Gila bicolor*, exhibited more complex distribution patterns, which varied on a temporal basis in relation to temperature and dissolved oxygen regimes. Tui chubs composed about 98% of the total catch at depths greater than 61 m. Trout production in this profundal zone was assumed to be negligible since the numbers present were low and the temperature was less than 7°C during all seasons.

80-001298 Williams, R. O. and R. G. Taylor. THE EFFECT OF WATER TEMPERATURE AND WINTER AIR TEMPERATURE ON THE SPRINGTIME MIGRATIONS OF KING MACKEREL IN THE VICINITY OF TAMPA BAY, FLORIDA. *Fla. Sci.*

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80-001298 CONTINUED 43(Suppl. 1):26. 1980. Abstract only. SFA 25(2)
[Fla. Dep. Nat. Resour. Mar. Res. Lab., 100 8th Ave. S.E., St. Petersburg 33701] This paper reviews the springtime migrations of the king mackerel, *Scomberomorus cavalla*, in the vicinity of Tampa Bay, Florida during each of the past twenty years and demonstrates that their date of first appearance is directly dependent on offshore water temperature (Min. 20°C) and indirectly on prevailing air temperatures during the previous winter. The springtime arrival date of king mackerel to the Tampa Bay area was established by reviewing daily newspaper recreational fishing columns. Offshore water temperatures were compiled from various sources and are available for twelve of the past twenty years. Air temperatures for Tampa, Florida were available from annual summaries of the U.S. National Weather Service.

FOODS/FEEDING

80-001299 Axell, M-B. FEEDING OF COD IN THE ÅLAND SEA AND ITS INFLUENCE ON THE STOCKS OF HERRING AND SPRAT. *Int. Counc. Explor. Sea.* C.M. 1979/J:22. 8p. 1979. In Finnish with English summ. SFA 25(2)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland] Altogether 460 cod, sampled in different seasons, were examined by the points method. The ratio of fish to invertebrates in their stomachs was 2:1. Sprat received higher points than herring (30.5% vs. 23.6%), although herring predominated in the stomachs of the larger cod. The food consumed by the stock of cod in the whole Baltic Sea was estimated on the basis of the data from the Åland Sea. The annual predation on the stock of herring was calculated as 35% and that on sprat as 58%. The food intake is given according to length groups to permit direct calculation of the annual consumption by a certain stock.

80-001300 Barwick, D. H. FOOD OF LARVAL BLACK CRAPPIES IN RELATION TO ELECTRICAL POWER GENERATION, KEOWEE RESERVOIR, SOUTH CAROLINA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:485-489. 1978[1979]. SFA 25(2)
[U.S. FWS, Southeast Reservoir Invest., Clemson, SC 29631] Food of larval (5.0-10.9 mm, TL) black crappies (*Pomoxis nigromaculatus*) from Keowee Reservoir, SC, was determined in 1973, before commercial power generation began from a 2,580-MW nuclear power plant, and in 1976 after 3 years of commercial power generation. Although water temperatures were higher in 1976 than in 1973, food of the larvae appeared to be unchanged by operation of the plant. The principal organisms eaten were *Diaphanosoma* sp. and copepod nauplii.

80-001301 Brock, R. E. THE EFFECTS OF GRAZING BY PARROTFISHES (FAMILY SCARIDAE) ON SELECTED SHALLOW HAWAIIAN MARINE COMMUNITIES. *Ph. D. dissertation, Univ. Wash.* 186p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2502. Dec. 1979. SFA 25(2)

80-001302 Cannamela, D. A.; J. D. Brader and D. W. Johnson. FEEDING HABITS OF CATFISHES IN BARKLEY AND KENTUCKY LAKES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:686-691. 1978[1979]. SFA 25(2)
[Hancock Biol. Stn., Murray State Univ., Murray, KY 42071] Indices of relative importance and forage ratios are presented for food items of channel (*Ictalurus punctatus*) and blue catfishes (*I. furcatus*) collected from

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80-001302 CONTINUED two large impoundments in western Kentucky. Data reported include samples collected from September 1977 to April 1978. Young of the year catfishes from both lakes relied heavily on zooplankton and aquatic insects. Other food items which were seasonally important included debris, trichopterans, bryozoans, and fish. Teleosts were the most important food items of intermediate sized (150-300 mm TL) catfishes in both lakes. Hexageniid mayflies were important to Kentucky Lake catfishes, but not to Barkley Lake catfishes; the converse was true of bryozoans. Omnivorous feeding habits characterized large harvestable (>300 mm TL) catfishes. Food items of harvestable catfishes included fish, insect larvae, debris, and one deermouse (*Peromyscus* sp.); pelecypods occurred consistently in the diet of Barkley Lake catfishes. Diversity of food items in catfish diets may be affected by the relative abundance of the 2 species in each lake. It is postulated that interactions between catfishes could alter availability and/or selection of food items.

80-001303 Clark, A. L. and W. D. Pearson. EARLY PISCIVORY IN POSTLARVAE OF THE WHITE BASS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:409-414. 1978[1979]. SFA 25(2)

[Woodward-Clyde Consultants, 3489 Kurtz St., San Diego, CA 92110] Gut content analysis of postlarval white bass (*Morone chrysops*) collected from the Ohio River near Louisville, Kentucky, revealed that prolarval carp (*Cyprinus carpio*) were the major food item for postlarvae of 7-12 mm standard length (SL), although no larval fish were found in the stomachs of postlarvae 12-13 mm SL. The frequency of occurrence of zooplankton (primarily copepods and cladocerans) in the diet increased steadily from 20 to 100% as the postlarvae grew from 6.5 to 13.0 mm SL. The ecological implications of such early piscivory are discussed.

80-001304 Combs, D. L. FOOD HABITS OF ADULT STRIPED BASS FROM KEYSTONE RESERVOIR AND ITS TAILWATERS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:571-575. 1978[1979]. SFA 25(2)

[Okla. Dep. Wildl. Conserv., Muskogee 74401] During 1974, 1975 and 1976, stomachs of 467 adult striped bass (*Morone saxatilis*) from Keystone Reservoir and its tailwaters were collected and examined for content. Gizzard shad (*Dorosoma cepedianum*) was the most abundant food item found in striped bass stomachs. The relationships between the length of striped bass and the length of gizzard shad consumed was not significant (.05%). Seasonal and habitat variations in the diet were not significant (.05%).

80-001305 Demski, L. S. A "HYPOTHALAMIC FEEDING AREA" IN THE BRAINS OF SHARKS AND TELEOSTS. *Fla. Sci.* 43(Suppl. 1):10. 1980. Abstract only. SFA 25(2)

[Sch. Biol. Sci., Univ. Ky., Lexington 40506] Recent findings in teleosts indicate that an area of the hypothalamus (dorsal or subglomerular part of the inferior lobe) is involved in the regulation of feeding. The results are based on experiments utilizing brain stimulation, lesion and recording techniques. At least in goldfish, neurons in this area are preferentially activated by olfactory and gustatory input. Comparative anatomical studies suggest that a similar and probably homologous area is present in the shark hypothalamus and feeding activity has been elicited by electrical stimulation of this area in free-swimming nurse sharks. Thus, although the direct evidence in elasmobranchs is still meager, it seems likely that the shark inferior lobe is also involved in the control of feeding. The indication from studies in teleosts that this region is sensitive to olfactory stimuli is consistent with frequent observations that many sharks and teleosts can be strongly aroused to feed in response to certain chemical stimuli.

FOODS/FEEDING

80-001306 Diana, J. S. THE FEEDING PATTERN AND DAILY RATION OF A TOP CARNIVORE, THE NORTHERN PIKE *(ESOX LUCIUS)*. *Can. J. Zool.* 57(11):2121-2127. Nov. 1979. In English with French summ. SFA 25(2)

[Ecol. Fish. Wildl. Prog., Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109] Food habits, digestive rates, and daily ration were determined for 1290 northern pike (*Esox lucius*) collected from Lac Ste. Anne, Alberta. The data were used to develop a model for quantifying the daily ration of a top carnivore; the basic feature was that feeding time was short relative to time between meals. Pike diet included mainly perch (*Perca flavescens*), spottail shiners (*Notropis hudsonius*), burbot (*Lota lota*), and white suckers (*Catostomus commersoni*), in order by numerical importance. Caloric intake by pike depended mainly on perch, suckers, and burbot, in that order; the difference between the two rankings was due to differences in the size of individuals eaten. Gastric evacuation rate (determined by controlled experiment) was 48 h in summer and 12 days in winter. Daily ration was high from May to August (peaking in June) and very low in winter. Both sexes of pike exhibited a spawning fast in late April. Female rations were 1.5 to 2.3 times the male values in summer and winter. The rare inclusion of large prey items, such as suckers and burbot, had a very significant effect on the total caloric intake of pike.

80-001307 Domermuth, R. B. and R. J. Reed. FOOD OF JUVENILE AMERICAN SHAD, *ALOSA SAPIDISSIMA*, JUVENILE BLUEBACK HERRING, *ALOSA AESTIVALIS*, AND PUMPKINSEED, *LEPOMIS GIBBOSUS*, IN THE CONNECTICUT RIVER BELOW HOLYOKE DAM, MASSACHUSETTS. *Estuaries* 3(1):65-68. Mar. 1980. SFA 25(2)

[Radiation Manage. Corp., Box 286, R.D. 1, Middletown, DE 19709] Despite a paucity of avilable prey, little feeding competition occurred between juvenile American shad, *Alosa sapidissima*, juvenile blueback herring, *Alosa aetivalis*, and pumpkinseed, *Lepomis gibbosus*, in the Connecticut River below Holyoke Dam. Pumpkinseed differed from clupeids in pronounced selection for chironomid larvae, and bottom feeding. Feeding conflicts between the two *Alosa* species were reduced by: 1) more opportunistic feeding by shad: 2) differential selection for cladoceran prey; 3) higher utilization of copepods by herring.

80-001308 Eldon, G. A. FOOD OF THE CANTERBURY MUDFISH, *NEOCHANNA BURROWSIUS* (SALMONIFORMES: GALAXIIDAE). *N.Z. J. Mar. Freshwater Res.* 13(2):255-261. 1979. SFA 25(2)

[Fish. Res. Div., Minist. Agric. Fish., Private Bag, Christchurch, New Zealand] Food found in the stomachs of 367 *Neochanna burrowsius* (Phillips) ranging in length from 6 to 167 mm was examined. Fish were collected from nine habitats, mainly in South Canterbury. Small monthly samples (mean of *n* + 13) of adult fish were collected for 9 months from one site, and 3 samples of fry came from the same place. Samples of juveniles were collected monthly for 7 months from a second site, and miscellaneous samples of adults or juveniles were collected from 7 other places. The stomachs of two samples of aestivating fish were also examined. Observations on feeding in an artificial pond showed that fish were attracted by live food but were incapable of catching swift prey. Food was predominantly insect larvae and Crustacea, chiefly chironomids and ostracods. Seventy-five per cent of aestivating fish were found to have food residues in their stomachs.

80-001309 Fahy, E. PREY SELECTION BY YOUNG TROUT FRY *(SALMO TRUTTA)*. *J. Zool. (Lond.)* 190(1):27-37. Jan. 1980. SFA 25(2)

[Fish. Res. Cent., Dep. Fish. For., Abbotstown, Castlenock, Co. Dublin, Ireland] Factors influencing the choice of invertebrate food by early feeding trout are sought, special attention being given to the dimensions of the prey. The stomach contents of fish of similar age feeding on lake plankton

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80-001309 CONTINUED and drifting stream fauna are compared. Little consistent preference was displayed for the smaller planktonic organisms but prey size was of importance in the distribution of stream benthos among predators of different lengths. The width of the prey was of greater significance to selection than the mean volume or the area of the largest surface of the food items. When the fish were in obvious competition for food the correlation between predator length and all prey dimensions improved.

80-001310 Fiscus, C. H. INTERACTIONS OF MARINE MAMMALS AND PACIFIC HAKE. *Mar. Fish. Rev.* 41(10):1-9. Oct. 1979. SFA 25(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] The biology, feeding habits, seasonal distribution, and range of the Pacific hake, *Merluccius productus*, are briefly described. The commercial hake fishery is also discussed. Marine mammals inhabiting the range of the Pacific hake are listed and population estimates are given when known. The known or suspected marine mammal predators on hake are described in detail. The range and seasonal distribution of each species is given and principal prey species (including hake) are discussed. A partial listing of fish which prey on hake is given.

80-001311 Fitzmaurice, P. SELECTIVE PREDATION ON CLADOCERA BY BROWN TROUT *SALMO TRUTTA* L. *J. Fish Biol.* 15(5):521-525. Nov. 1979. SFA 25(2)
[Inland Fish. Trust, Inc., Glasnevin, Dublin 9, Ireland] The size and species composition of zooplankton ingested by brown trout in Lough Sheelin was studied. Zooplankton and fish samples were taken simultaneously. The zooplankton samples consisted of *Daphnia hyalina* var. *galeata*, Copepoda and *Bythotrephes longimanus* in the proportion of 246:10:1. The entire stomach contents of the fish were examined with particular attention paid to the zooplankton component. The results indicated a high degree of selection for *B. longimanus*.

80-001312 Foltz, J. W. and S. H. Bowen. CHROMIC OXIDE IN FOOD ASSIMILATION STUDIES. *Trans. Am. Fish. Soc.* 108(6):650-652. Nov. 1979. SFA 25(2)
[Dep. Entomol. Econ. Zool., Clemson Univ., Clemson, SC 29631]

80-001313 Geistdoerfer, P. RECHERCHES SUR L'ALIMENTATION DE *MACROURUS BERGLAX* LACÉPÈDE 1801 (MACROURIDAE, GADIFORMES). [STUDIES ON THE FOOD OF *MACROURUS BERGLAX* LACÉPÈDE, 1801 (MACROURIDAE, GADIFORMES).] *Ann. Inst. Oceanogr.* 55(2):135-144. 1979. In French with English summ. SFA 25(2)
[Lab. Ichtyol. Gen. Appl., Mus. Natl. Hist. Nat., 43 rue Cuvier F 75231 Paris, France] The food habits of *Macrourus berglax* were studied at various seasons in the North Atlantic. The 584 *M. berglax* specimens (2078 preys) came from 88 trawl catches made by *Thalassa* and *Cryos*, research vessels of the Institut scientifique et technique des Pêches maritimes: in the Barents Sea, in summer 1974; on the Iceland-Faeroë Ridge, in spring 1975; in the Labrador Sea, in summer 1975 and winter 1976; in the Baffin Sea, in autumn 1977. *M. berglax* feeds essentially on benthic groups, especially two major categores: 1) Amphipods Gammarids (24.1 % of prey), Ophiuroids (20.1 %) and Polychaetes (15.5 %): 2) Fishes (8.9 %) and Shrimps (8.6 %). The amount of these two categores ingested varies in relation to the size of *M. berglax*: as the fish grow the intake of the first category decreases sharply.

80-001314 Gillen, A. L. and T. Hart. FEEDING INTERRELATIONSHIPS BETWEEN THE SAND SHINER AND THE STRIPED SHINER. *Ohio J. Sci.* 80(2):71-76. Mar. 1980. SFA 25(2)

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80-001314 CONTINUED
[Dep. Zool., Ohio State Univ., 1735 Neil Ave., Columbus, 43210] Feeding habits of *Notropis stramineus* and *N. chrysocephalus* were investigated in Buffalo Creek, Washington County, PA during September through December, 1977. As an opportunistic feeder, *N. stramineus* consumed large quantities of terrestrial (appx. 40%) and aquatic (appx. 50%) insects during September and October, but shifted almost entirely to insects in the benthic environment (ppx. 90%), such as mayfly numphs (*Caenis* and *Stenonema*) and stonefly nymphs (*Alloperla* and *Isoperla*), in November and December. *N. stramineus* utilized a wide range of prey with the bulk of aquatic prey (9-12 mm) including crayfish (*Orconectes*), large mayfly nymphs (*Stenonema*), and damselfly naiads (*Argia*) from September through November; however, in December its diet shifted to *Cladophora* and aquatic Chironomidae larvae. Although diet overlap was nearly complete initially (September and October), it diminished as the season progressed. Food habits were unique to each species late in the year, suggesting that as food resources decline the food habits of these two species appear to diverge, minimizing interspecific competition.

80-001315 Gruber, S. H. ROLE OF THE LEMON SHARK *NEGAPRION BREVIROSTRIS* AS A PREDATOR IN THE TROPICAL MARINE ENVIRONMENT: A PROGRESS REPORT. *Fla. Sci.* 43(Suppl. 1):10. 1980. Abstract only. SFA 25(2)
[RSMAS, Univ. Miami, Miami, FL 33149]

80-001316 Heller, R. and M. Milinski. OPTIMAL FORAGING OF STICKLEBACKS ON SWARMING PREY. *Anim. Behav. (Baillière Tindall, London)* 27(4):1127-1141. Nov. 1979. SFA 25(2)
[Abt. Biol., Ruhr-Univ. Bochum, Postfach 102148, 4630 Bochum 1, West Germany] Hungry sticklebacks, *Gasterosteus aculeatus*, preferentially attacked the densest region of a swarm of water fleas, but with decreasing attack readiness they increasingly preferred less dense regions. Such a hunger dependent change in feeding preference has not yet been dealt with by optimal foraging theory. A model, which assumes that high swarm densities provide high feeding rates (because of small inter-prey distances) but also high costs of confusion, predicts that a predator should always choose the lowest prey density in which it can achieve a feeding rate sufficient to satisfy its hunger. Some predictions of the model were experimentally verified. Hungry fish have a higher feeding rate in a high prey density than in a low density and less hungry fish have a higher rate in a low density than in a high density.

80-001317 Hoover, J. J. FEEDING ECOLOGY OF TWO SYMPATRIC SPECIES OF *NOTROPIS* (PISCES: CYPRINIDAE) FROM THE HILLSBOROUGH RIVER. *Fla. Sci.* 43(Suppl. 1):25. 1980. Abstract only. SFA 25(2)
[Dep. Biol., Univ. South Fla., Tampa 33620] Collections of *N. petersoni* and *N. hypselopterus* from the Hillsborough River were made during the periods August 1973-May 1974 and April 1978-June 1979, in order to ascertain the feedig habits of the two species. Both fish fed on aufwuchs, with the dominant food items represented by diatoms, *Closterium*, rotifers, pelecypods, crustaceans, and aquatic insects. The consumption of adult chironomids indicated that *N. hypselopterus*, and to a lesser extent, the smaller stages of *N. petersoni*, had greater accessibility to these insects than did the larger individuals of *N. petersoni* occurring deeper in the water column. Horn's Coefficient of Dietary Overlap was calculated between the two species and was often in excess of .60, but during both sampling periods exhibited autumn and early winter depressions when overlap was comparatively low (.01-.31).

FOODS/FEEDING

80-001318 Ishiwata, N. [ECOLOGICAL STUDIES ON THE FEEDING OF FISHES--XI. EXTERNAL FACTORS AFFECTING SATIATION AMOUNT]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1275-1276. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Tokyo Univ. Fish., Minato-ku, Tokyo 108, Japan] The satiation amount is standardized by the method described in the previous reports and the influence of the size of school on the satiation amount is examined. The results obtained are summarized as follows: The satiation amount of a school of fish declines when its number falls below a certain number, thus exhibiting group effect. This is an example of a psychological factor influencing food consumption.

80-001319 Kokova, V. Ye. THE FEEDING OF LARVAE OF THE WHITEFISH, *COREGONUS LAVARETUS LUDOGA*, THE BAIKAL OMUL, *COREGONUS AUTUMNALIS MIGRATORIUS*, AND THE "PELED", *COREGONUS PELED*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):953-960. 1978. SFA 25(2)
[Inst. Phys., Siberian Dep., USSR Acad. Sci., Krasnoyarsk, USSR]

80-001320 Lane, E. D.; M. C. S. Kingsley and D. E. Thornton. DAILY FEEDING AND FOOD CONVERSION EFFICIENCY OF THE DIAMOND TURBOT: AN ANALYSIS BASED ON FIELD DATA. *Trans. Am. Fish. Soc.* 108(6):530-535. Nov. 1979. SFA 25(2)
[Biol. Dep., Malaspina Coll., 900 5th St., Nanaimo, BC V9R 5S5, Canada]

80-001321 Langton, R. W. and R. E. Bowman. FOOD OF FIFTEEN NORTHWEST ATLANTIC GADIFORM FISHES. *NOAA Tech. Rep. NMFS SSRF* 740. iv + 23p. Feb. 1980. SFA 25(2)
[NMFS, Woods Hole, MA 02543] The food of 15 species of gadiform fishes occurring in the northwest Atlantic, from Cape Hatteras, N.C., to Nova Scotia have been investigated for the years 1969-72. The populations of Atlantic cod, *Gadus morhua*; pollock, *Pollachius virens*; silver hake, *Merluccius bilinearis*; white hake, *Urophycis tenuis*; offshore hake, *Merluccius albidus*; and cusk, *Brosme brosme*; have reasonably similar diets, being primarily piscivorous. The red hake, *Urophycis chuss*, and spotted hake, *Urophycis regius*, also have similar diets and are mixed feeders, preying on both fish and invertebrates. The final seven species, haddock, *Melanogrammus aeglefinus*; longfin hake, *Phycis chesteri*; fourbeard rockling, *Enchelyopus cimbrius*; marlin-spike, *Nezumia bairdi*; longnose grenadier, *Coelorhynchus carminatus*; fawn cusk-eel, *Lepophidium cervinum*; and ocean pout, *Macrozoarces americanus*; prey almost exclusively on invertebrates.

80-001322 Liem, K. F. ADAPTIVE SIGNIFICANCE OF INTRA- AND INTERSPECIFIC DIFFERENCES IN THE FEEDING REPERTOIRES OF CICHLID FISHES. *Am. Zool.* 20(1):295-314. 1980. SFA 25(2)
[Mus. Comp. Zool., Harvard Univ., Cambridge, MA 02138]

80-001323 Linfield, R. S. J. ECOLOGICAL CHANGES IN A LAKE FISHERY AND THEIR EFFECTS ON A STUNTED ROACH *RUTILUS RUTILUS* POPULATION. *J. Fish Biol.* 16(2):123-144. Feb. 1980. SFA 25(2)
[Anglian Water Auth., Diploma House, Grammar School Walk, Huntingdon, Cambs. PE18 6NZ, England] Data for two sampling years (1969/70 and 1970/71) is presented to illustrate the changing composition, density and biomass of the macroinvertebrate fauna in a South Lancashire lake. Six faunal groupings are recognised for a non-parametric analysis of the data and significance levels are given for the between-station and between-year differences recorded. The mean density of macroinvertebrates (1-2 mm mesh sieve) estimated for the lake as a whole increased by 28.5% in the second year ($2519/m^2$-$3237/m^2$) whereas the estimated mean biomass in g/m^2

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80-001323 CONTINUED increased by 86% wet weight (8.61-16.01) and 196% dry weight (1.74-5.15). Molluscs contributed substantially to the increased standing crop which was accompanied by increased development of macrophytes. A comparative study of the diets of roach in two size groups in winter and summer is described. The variety of food items consumed was found to be greater than in a preliminary study in May 1969 and, for the roach sampled, the average quantity of food consumed per fish increased after the 1969/70 winter. The possible relationships between invertebrate standing crop, roach diet and previously reported changes in the growth of the roach are discussed and an explanation is offered concerning the sequence of biological changes observed in the lake.

80-001324 Longval, M. and R. Warner. FOOD INTAKE OF THE LEMON SHARK *NEGAPRION BREVIROSTRIS* UNDER CONTROLLED CONDITIONS. *Fla. Sci.* 43(Suppl. 1):10. 1980. Abstract only. SFA 25(2)

[RSMAS, Univ. Miami, Miami, FL 33149] Food intake of the lemon shark was investigated to determine whether apparent hunger and satiation plays a role in their behavior. Lemon sharks (two males and two females) were placed under constant conditions and given 45-minute feeding trials per day for 100 days. During a trial the sharks were offered pre-weighed, 10 gram pieces of catfish filet and their *ad libitum* rate of feeding individually monitored. The average shark consumed 50.7 g per day (5065 g in 95 days) and gained 867.2 g. It thus converted 17.1% of its ration into growth and storage. The remaining 82.9% was metabolized or excreted. An 8% increase in total length was also recorded. A time-series analysis of the intake data revealed peaks at 4 and 7 days. We suggest that the 4-day peak reflects an internally-mediated periodic variable. The 7-day peak is probably an experimental artifact. This differs from an earlier study which claimed 15-day periods of food intake.

80-001325 MacCrimmon, H. R. and T. K. Twongo. ONTOGENY OF FEEDING BEHAVIOUR IN HATCHERY-REARED RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON. *Can. J. Zool.* 58(1):20-26. Jan. 1980. In English with French summ. SFA 25(2)

[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada] Development of feeding behaviour in young rainbow trout, *Salmo gairdneri*, from "swim-up" to day 57 after hatch at 8.5°C is described relative to food type (live *Artemia salina* or dry trout ration) and water flow (current or no current). Earliest signs of feeding behaviour appear during the process of swim-up at days 27 to 29, with the movement of the eyes to fixate particles and the beginning of a snap response which intensifies within 2 days. Initially the alevins are nonselective between food and inert targets, but by about day 25 at the test temperature they have become able to discriminate food from nonfood items, and show a marked increase in exogenous feeding activity. The timing, which will differ at different rearing temperatures, coincides approximately with final absorption of the visible yolk sac and follows disappearance of the oesophageal plug by about 10 days. This would seem to be the best time to initiate artificial feeding of hatchery-reared alevins, with the fish showing a preference for ingestion of live food (shrimp nauplii) over dry rations. Despite evident behavioural differences in current and no-current conditions this factor had little effect on timing or ultimate success of first feeding. Failure of some alevins to begin feeding, or feed adequately for survival, is associated with the agonistic behaviour of more aggressive siblings.

80-001326 Markovtsev, V. G. FOOD CHAINS AND FISH PRODUCTION IN LAKE KHANKA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1017-1021. 1978. SFA 25(2)

FOODS/FEEDING

80-001326 CONTINUED
[TINRO, Vladivostok, USSR] The food supply of the lake is represented mainly by organisms from four trophic levels. It is possible to assume approximately that around 10% of the final fish production is formed from organisms of the first trophic level, 33% from organisms of the second trophic level, 47% from organisms of the third trophic level and 10% from organisms of the fourth trophic level. Such a distribution of the final fish production by trophic levels is one of the reasons for the existing low fish productivity of the lake. Starting from an analysis of the trophic links of the most abundant commercial species of the lake it is possible to recommend intensive hatchery propagation of the carp, silver carp, grass carp and also non-migratory predators, mainly the skygazer.--Concl.

80-001327 Mikhman, A. S. and M. I. Bryazgunova. THE FEEDING OF *SCOPHTHALMUS MAEOTICUS MAEOTICUS* AND *PLATICHTHYS FLESUS LUSCUS* LARVAE IN TAGANROG GULF. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):857-858. 1978. SFA 25(2)
[AzNIIRKh, Rostov on Don, USSR]

80-001328 Milinski, M. AN EVOLUTIONARILY STABLE FEEDING STRATEGY IN STICKLEBACKS. *J. Comp. Ethol.* 51(1):36-40. Sept. 1979. In English with German summ. SFA 25(2)
[Abt. Biol., Ruhr-Univ. Bochum, West Germany] When offered a choice between two simulated drift food patches 6 three-spined sticklebacks (*Gasterosteus aculeatus* L.) distributed themselves between the two patches in the ratio of patch profitabilities. This is an example of an "ideal free distribution" which could be achieved either if all fishes used the same pure strategy of feeding where reward rate is assessed to be highest, or if they adopted a mixture of that strategy and of random choice. Conditions for either possibility to be evolutionarily stable are discussed.

80-001329 Milinski, M. CAN AN EXPERIENCED PREDATOR OVERCOME THE CONFUSION OF SWARMING PREY MORE EASILY? *Anim. Behav. (Baillière Tindall, London)* 27(4):1122-1126. Nov. 1979. SFA 25(2)
[Abt. Biol., Ruhr-Univ. Bochum, Postfach 102148, 4630 Bochum 1, West Germany] Three-spined sticklebacks (*Gasterosteus aculeatus* L.) which had previously fed on *Daphnia* in a high density swarm subsequently attacked a prey swarm (which had all known characteristics enhancing confusion) differently from fish fed equal numbers of *Daphnia* from a lower density swarm. Predators which had previously encountered low density prey hesitated longer before the first attack, attacked less and at a lower rate, and ceased hunting earlier than those fish that had previously prefed upon the high density *Daphnia*. Possible causes of the difference in attack behaviour are discussed.

80-001330 Morris, D. J. and B. J. Follis. EFFECTS OF STRIPED BASS PREDATION UPON SHAD IN LAKE E. V. SPENCE, TEXAS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:697-702. 1978[1979]. SFA 25(2)
[Tex. Parks Wildl. Dep., Ingram 78025] Striped bass (*Morone saxatilis*) introduced into Lake E. V. Spence, a west Texas reservoir, showed reduced growth rates as shad (*Dorosoma* sp.) declined. To study the relationship between these phenomena, scales and stomach samples were collected from striped bass caught in gill nets, and the standing crop of shad was estimated from rotenone samples in August, 1972-1978. Declines in both striped bass

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80-001330 CONTINUED growth and occurrence of food items in their stomachs coincided with the depletion of 76 and 178 mm shad after 1972. Surviving gizzard shad (*D. cepedianum*) grew rapidly, but threadfin shad (*D. petenense*) virtually disappeared as brood fish were decimated. Reducing the annual stocking rate rate from 24.7 to 12.4 striped bass fingerlings/ha in 1976 may have allowed gizzard shad to establish sufficient reproductive capacity to provide adequate forage.

80-001331 Nielsen, L. A. EFFECT OF WALLEYE (*STIZOSTEDION VITREUM VITREUM*) PREDATION ON JUVENILE MORTALITY AND RECRUITMENT OF YELLOW PERCH (*PERCA FLAVESCENS*) IN ONEIDA LAKE, NEW YORK. *Can. J. Fish. Aquatic Sci.* 37(1):11-19. Jan. 1980. In English with French summ. SFA 25(2)
[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061]

80-001332 Pearcy, W. G.; C. C. E. Hopkins; S. Grønvik and R. A. Evans. FEEDING HABITS OF COD, CAPELIN, AND HERRING IN BALSFJORDEN, NORTHERN NORWAY, JULY-AUGUST 1978: THE IMPORTANCE OF EUPHAUSIIDS. *Sarsia* 64(4):269-277. 1979. SFA 25(2)
[Sch. Oceanogr., Oreg. State Univ., Corvallis 97331] Midwater and bottom trawls were used at two stations (120 and 180 m depth) in Balsfjorden during the summer of 1978 to study the feeding of fishes on euphausiids, one of the major causes of 120 kHz sound scattering. The principal food of cod consisted of capelin (*Mallotus villosus*), euphausiids (*Thysanoessa rachii, T. inermis*, and *Meganyctiphanes norvegica*), and shrimp (*Pandalus borealis*). At the 120 m station, herring and small cod fed mainly on euphausiids. Because of diel vertical migrations, euphausiids are presumably close to the bottom during the day at this depth, and hence very susceptible to predation by both pelagic and benthic fishes. During the darkest period of the 24-hr day cod caught in midwater (50-70 m depth) had appreciable quantities of fresh euphausiids in their stomachs. At the 180 m station euphausiids were relatively unimportant in the food of cod caught in the bottom trawls but were numerous in cod caught in midwater trawls at depths of the 120 kHz sound scattering layer. The scattering layer did not impinge on the bottom at this station. It migrated from depths of about 150 m by day into the upper 100 m at night; both capelin and cod were associated with the layers. Although copepods were the most numerous type of prey in capelin stomachs from the 180 m station, euphausiids predominated volumetrically.

80-001333 Phillips, R. R. and S. B. Swears. SOCIAL HIERARCHY, SHELTER USE, AND AVOIDANCE OF PREDATORY TOADFISH (*OPSANUS TAU*) BY THE STRIPED BLENNY (*CHASMODES BOSQUIANUS*). *Anim. Behav. (Baillière Tindall, London)* 27(4):1113-1121. Nov. 1979. SFA 25(2)
[Dep. Biol., State Univ. Coll., Oneonta, NY 13820] This paper describes a three-part examination of the predatory relationship between oyster toadfish (*Opsanus tau*) and striped blennies (*Chasmodes bosquianus*). In the first laboratory study, blennies avoided the toadfish when placed in a choice situation. During the second laboratory study, dominant blennies escaped attack significantly more than did subordinates by using a protective shelter. A field study demonstrated that toad fish will attack active but tethered blennies under natural conditions. As predators, toadfish appear to use a mixed strategy. During the day, when they are relatively inactive, they may feed as ambush predators. However, we suggest that at night they move about actively, stalking benthic invertebrates and small fishes. They also feed as scavengers, consuming a variety of foods.

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80-001334 Portsev, P. I. THE FEEDING OF THE CUTLASSFISH, *TRICHIURUS LEPTURUS* (PISCES, TRICHIURIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):775-781. 1978. SFA 25(2)

[AzCherNIRO, Kerch, USSR] On the basis of dissected stomachs of cutlassfish data are presented characterizing its feeding off the coast of Oman. The food spectrum of the cutlassfish is composed of small demersal and pelagic fishes, Cephalopoda and crustaceans. Their main food is fish. The food composition of the cutlassfish does not vary noticeably in different seasons. The daily feeding rhythm during the summer period is examined. The reasons for a change in feeding intensity during the day are discussed. Data on the distribution of fish and of their food depth are presented.

80-001335 Robb, A. P. and J. R. G. Hislop. THE FOOD OF FIVE GADOID SPECIES DURING THE PELAGIC 0-GROUP PHASE IN THE NORTHERN NORTH SEA. *J. Fish Biol.* 16(2):199-217. Feb. 1980. SFA 25(2)

[Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland] The diets of five gadoid species in the northern North Sea are described: the cod, *Gadus morhua* (L.): haddock, *Melanogrammus aeglefinus* (L.): whiting, *Merlangius merlangus* (L.); saithe, *Pollachius virens* (L.); and the Norway pout, *Trisopterus esmarkii* (L.). The diet of each species was shown to be a gradual progression to different prey species as the predators increased in length. There were differences in the food taken by each species with respect to numbers, species and size. These differences in diet suggest that the degree of competition between pelagic 0-group gadoids is not great.

80-001336 Stickney, R. R. and R. B. McGeachin. FOOD HABITS OF FISHES ASSOCIATED WITH MARSHLAND DEVELOPED ON DREDGED MATERIAL. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:547-560. 1978[1979]. SFA 25(2)

[Dep. Wildl. Fish Sci., Tex. A&M Univ., College Station 77843] The food habits of *Micropogon undulatus, Leiostomus xanthurus, Fundulus similis, Cyprinodon variegatus, Menidia beryllina* and *Membras martinica* were studied in conjunction with the development of a man-made salt marsh planted during 1976 on Bolivar Peninsula, Galveston Bay, TX. Each of the fishes studied fed to a considerable extent on the benthos community, and utilized at least some zooplanktonic and terrestrial insect foods. The dominant food organisms in the fish stomachs examined corresponded, in general, with those previously reported by other investigators. The artificially created salt marsh on Bolivar Peninsula appeared to provide habitats, both for fishes and their foods, similar to those of natural marshland areas along the coasts of the Gulf of Mexico and the southeastern United States.

80-001337 Stoner, A. W. THE MACROBENTHOS OF SEAGRASS MEADOWS IN APALACHEE BAY, FLORIDA, AND THE FEEDING ECOLOGY OF *LAGODON RHOMBOIDES* (PISCES: SPARIDAE). *Ph.D. dissertation, Fla. State Univ.* 187p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4105. Mar. 1980. SFA 25(2)

80-001338 Tremblay, D. and G. J. Fitzgerald. SOCIAL ORGANIZATION AS AN ANTI-PREDATOR STRATEGY IN FISH. *Nat. Can. (Que.)* 106(3):411-413. May-June 1979. In English with French summ. SFA 25(2)

[Dep. Biol., Univ. Laval, Quebec G1K 7P4, Canada] The efficiency of a predator, the common piranha, *Serrasalmus spilopleura*, preying upon various densities of schooling zebra danios, *Brachydanio rerio*, and non-schooling goldfish, *Carassius auratus*, was evaluated as a function of prey density and distribution. The predator made more attacks and was significantly more successful against non-schooling than against schooling fish.

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80-001339 Wells, L. FOOD OF ALEWIVES, YELLOW PERCH, SPOTTAIL SHINERS, TROUT-PERCH, AND SLIMY AND FOURHORN SCULPINS IN SOUTHEASTERN LAKE MICHIGAN. *U.S. Fish Wildl. Serv. Tech. Pap.* 98. 12p. 1980. SFA 25(2)

Stomachs of 1,064 alewives (*Alosa pseudoharengus*), 1,103 yellow perch (*Perca flavescens*), 246 spottail shiners (*Notropis hudsonius*), 288 trout-perch (*Percopsis omiscomaycus*), 454 slimy sculpins (*Cottus cognatus*), and 562 fourhorn sculpins (*Myoxocephalus quadricornis*) from Lake Michigan were examined for food contents. Fish were sampled primarily from March to November and nearly all were caught at the bottom in the southeastern part of the lake near Saugatuck, Michigan. Depths of capture (m) were: alewives, 5 to 110; yellow perch, 5 to 26; spottail shiners, 5 to 31; trout-perch, 9 to 46; slimy sculpins, 31 to 91; and fourhorn sculpins, 73 to 110. Alewives, particularly those less than 140 mm long, fed chiefly on zooplankton: *Pontoporeia* usually constituted most of the rest of the food, although *Mysis* and immature midges were occasionally eaten in considerable quantity. Yellow perch ate primarily *Pontoporeia*, fish, fish eggs, *Mysis* and crayfish; *Pontoporeia* was consumed most heavily by perch less than 250 mm long and those in relatively deep water, fish (mainly slimy sculpins) by those 200 mm long or longer, *Mysis* by those in deep water, and crayfish by those on rocky bottom. Spottail shiners fed most commonly on immature midges, *Pontoporeia*, zooplankton, fingernail clams, and (in July only) fish eggs; immature midges were eaten mainly by shiners in shallow water; and *Pontoporeia* by those in deeper areas. The diet of trout-perch was strongly dominated by *Pontoporeia* and immature midges. Slimy sculpins ate *Pontoporeia* almost exclusively. Fourhorn sculpins fed almost entirely on *Mysis* and *Pontoporeia: Pontoporeia* was particularly important in the diet of the larger fish.

80-001340 Wilsman, L. A. RESOURCE PARTITIONING AND MECHANISMS OF CO-EXISTENCE OF BLACKCHIN AND BLACKNOSE SHINERS (*NOTROPIS*: CYPRINIDAE). *Ph.D. dissertation, Mich. State Univ.* 130p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4107. Mar. 1980. SFA 25(2)

[The results suggest that the greater success of the black-chin relative to the blacknose in Lawrence Lake may be due to its ability to opportunistically forage a wider range of habitats under low resource conditions. Predation is implicated both as an important constraint to ecological segregation by the shiners as well as an ameliorating factor to competition. The decline in food intake by the shiners across the summer, though, indicates that predation was not severe enough to maintain shiner populations below levels at which food was limiting.--From abstr.

80-001341 Zadorozhnaya, Ye. A. THE SEASONAL AND DIURNAL DYNAMICS OF THE FEEDING OF THE WHITE BREAM, *BLICCA BJOERKNA*, FROM MOZHAYSK RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):765-775. 1978. SFA 25(2)

[Dep. Ichthyol., Moscow Univ., USSR] The seasonal and diurnal dynamics of feeding of the white bream, *Blicca bjoerkna*, from Mozhaysk reservoir was studied under different annual hydrologic regimes. The qualitative composition of the food of the white bream is similar from year to year. Chironomidae larvae are the main food. When chironomid biomass is low white bream change over to feeding on the young of the ruffe, *Acerina cernua*, or on crustaceans. The white bream fed less intensively in years with low water level and water temperature. Data on rations and the composition of components from various trophic levels are presented.

80-001342 Zakora, L. P. THE FEEDING OF THE STERLET, *ACIPENSER RUTHENUS*, AND ITS UTILIZATION OF THE FOOD RESOURCES OF VOLGOGRAD RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):946-952. 1978. SFA 25(2)

[Saratov Dep., State Res. Inst. Lake River Fish., USSR] Long-term data on the feeding of the sterlet, *Acipenser ruthenus*, in Volgograd reservoir were analyzed. On the basis of changes in the annual rations and food

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80-001342 CONTINUED coefficients, an assessment is given of the food supply to the population during different times of the existence of the reservoir. Data are presented on the degree of utilization by the sterlet of plankton and benthos production. It is shown that favorable conditions have been created in the reservoir for the feeding of the sterlet. In order to increase the abundance of the sterlet, the release of its young into the most eutrophic arms of the reservoir is recommended.

AGE AND GROWTH

80-001343 Nævdal, G.; M. Holm; R. Lerøy and D. Møller. INDIVIDUAL GROWTH RATE AND AGE AT SEXUAL MATURITY IN RAINBOW TROUT. *Fiskeridir. Skr. Ser. Havunders.* 17(1):1-10. 1979. SFA 25(2)
[Inst. Mar. Res., Dir. Fish., Bergen, Norway]

80-001344 Nævdal, G.; Ø. Bjerk; M. Holm; R. Lerøy AND D. Møller. GROWTH RATE AND AGE AT SEXUAL MATURITY OF ATLANTIC SALMON SMOLTIFYING AGED ONE AND TWO YEARS. *Fiskeridir. Skr. Ser. Havunders.* 17(1):11-17. 1979. SFA 25(2)
[Inst. Mar. Res., Dir. Fish., Bergen, Norway]

80-001345 Adelman, I. R. UPTAKE OF ^{14}C-GLYCINE BY SCALES AS AN INDEX OF FISH GROWTH: EFFECT OF FISH ACCLIMATION TEMPERATURE. *Trans. Am. Fish. Soc.* 109(2):187-194. Mar. 1980. SFA 25(2)
[Dep. Entomol. Fish. Wildl., Univ. Minn., St. Paul 55108]

80-001346 Bowen, S. H. DETRITAL NONPROTEIN AMINO ACIDS ARE THE KEY TO RAPID GROWTH OF *TILAPIA* IN LAKE VALENCIA, VENEZUELA. *Science* 207(4436):1216-1218. 14 Mar. 1980. SFA 25(2)
[Dep. Biol. Sci., Mich. Technol. Univ., Houghton 49931] The detritivorous cichlid *Sarotherodon mossambicus* grows rapidly on a low-protein diet by assimilating detrital nonprotein amino acids. Differences in the quantity of detrital amino acids in different lakes may account for the variable success of *S. mossambicus* introductions around the world.

80-001347 Budnichenko, V. A. and L. A. Nor. SOME FEATURES OF THE GROWTH OF *SAURIDA UNDOSQUAMIS* AND *S. TUMBIL* (PISCES, SYNODONTIDAE) IN THE ARABIAN SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):750-755. 1978. SFA 25(2)
[AzCherNIRO, Kerch, USSR]

80-001348 Catchings, E. D. AGE AND GROWTH OF REDEYE BASS IN SHOAL AND LITTLE SHOAL CREEKS, ALABAMA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:380-390. 1978[1979]. SFA 25(2)
[Ala. Dep. Conserv. Nat. Resour., Game Fish Div., Eastaboga, 36260] The age and growth of redeye bass (*Micropterus coosae*) in Shoal Creek and Little Shoal Creeks, Alabama, were determined. Shoal Creek redeye bass, on the average, grew faster than redeye bass in other studies. Little Shoal Creek redeye bass grew slower during the first 6 years of life than redeye bass in other areas with the exception of redeye bass in Sheed's Creek, TN; however,

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80-001348 CONTINUED by age VII Little Shoal Creek redeye bass were slightly larger than Shoal Creek redeye bass. Condition factors (K_n) of Shoal and Little Shoal Creek redeye bass relative to Alabama state wide averages for redeye bass and to redeye bass from other waters were computed. The redeye bass from Shoal and Little Shoal Creeks were in poorer condition relative to the average for Alabama redeye bass and to redeye bass in other waters. The condition of redeye bass in Shoal and Little Shoal Creeks improved as the fish grew relative to redeye bass in other waters.

80-001349 Eiras, J. C. and S. Carrasa. NOTE SUR LA BIOLOGIE DE *MUGIL CEPHALUS* (L.) DU NORD DU PORTUGAL: VARIATIONS ANNUELLES DES RAPPORTS POIDS-LONGUEUR, DU RAPPORT HÉPATOSOMATIQUE ET DU COEFFICIENT DE CONDITION. [NOTE IN THE BIOLOGY OF *MUGIL CEPHALUS* (L.) FROM NORTHERN PORTUGAL: ANNUAL VARIATIONS IN LENGTH-WEIGHT RELATIONSHIPS, HEPATOSOMATIC RELATIONSHIP AND COEFFICIENT OF CONDITION. *Nat. Can.(Que.)* 106(3):415-419. May-June 1979. In French. SFA 25(2)

[Inst. Zool. "Dr. Augusto Nobre" Fac. Cienc., Porto, Portugal]

80-001350 Guier, C. R.; W. G. Miller; A. W. Mullis and L. E. Nichols. COMPARISON OF GROWTH RATES AND ABUNDANCE OF LARGEMOUTH BASS IN SELECTED NORTH CAROLINA COASTAL RIVERS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:391-400. 1978[1979]. SFA 25(2)

[N.C. Wildl. Resour. Comm., Div. Inland Fish., 512 N. Salisbury St., Raleigh 27611] Age-growth relationships, length-weight relationships, and relative abundance indices were determined for largemouth bass (*Micropterus salmoides*) collected from the Cape Fear, Chowan, Pasquotank and Tar-Pamlico river systems in North Carolina during 1976. Largemouth bass in the Pasquotank River had the highest mean annual growth rate during their first and second years when compared to those in the other river systems studied. Largemouth in the Tar-Pamlico River system had the highest mean annual growth rates for age groups III and older. The growth rate of the Chowan River largemouth population was intermediate between those of the Pasquotank and the Tar-Pamlico rivers, while populations in the Cape Fear River had the slowest growth. Largemouth bass in the Chowan, Pasquotank, and Tar-Pamlico rivers attain legal harvestable size and recruit into the fishery at 305 mm in total length during their fourth growing season. The Cape Fear River largemouth population did not reach this harvestable size and until the fifth growing season. Largemouth bass were found in order of decreasing abundance in the Chowan, Cape Fear, Tar-Pamlico, and Pasquotank rivers.

80-001351 Hart, J. L. AGE AND GROWTH OF THE BLUEGILL, *LEPOMIS MACROCHIRUS* RAFINESQUE, IN A NEWLY IMPOUNDED FARM POND. *Trans. Kans. Acad. Sci.* 82:211-217. 1979. SFA 25(2)

[Box 626, Winfield, KS 67156] Rate of growth of 589 bluegills, *Lepomis macrochirus* Rafinesque, collected in 1974 and 1975 from a farm pond in northwestern Kansas, was determined by the scale method. The body-scale relationship was linear with an intercept of 18.0519 mm total length. The length-weight relationship was described by the equation $W = 6.19 \times 10^6 L^{3.2327}$. Annulus formation began in late April and was completed by early June. Average total lengths were 37 mm, 101 mm, 159 mm and 164 mm for ages I through IV respectively. The growth rate was generally greater than in other areas of the central states. Males outnumbered females in the sample, but this appeared to result from sampling bias rather than from unequal sex ratios. Males averaged longer than females in all age groups, but the difference was significant only in the fourth year of growth. Spawning was 80 percent complete by late May.

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80-001352 Jayaprakash, A. A. AGE AND GROWTH OF THE JUVENILES OF KOTH *OTOLITHOIDES BRUNNEUS* (DAY) IN BOMBAY WATERS. *Indian J. Fish.* 23(1/2):86-96. 1976. SFA 25(2)

[Bombay Res. Cent., C.M.F.R. Inst., Bombay-1, India] The age and growth of juveniles of 'Koth', *Otolithoides brunneus* (Day), were determined by three methods; 1) length-frequency distribution 2) scales 3) otoliths. The length attained at the completion of I to IV years of life as deduced from the length-frequency studies were 40.0, 60.0, 80.0 and 95.0 cm, respectively. The corresponding length calculated from scales for the same were found to be 40.7, 57.8, 75.6 and 91.3 cm. By the time the scales develop one ring the otoliths showed three 'larval rings'. The period of formation of the first scale ring corresponds to that of the fourth ring in the otoliths. The period of formation of the rings in the scales was found to coincide with the winter months, October to February. The formation of the rings may be due to low temperature prevailing during this period. The value of L_∞ obtained by using Walford's growth transformation is 198 cm. The K and L_∞ values estimated by von Bertalanffy equation were 0.14 and 206.4 cm respectively.

80-001353 Kerby, J. H. and E. B. Joseph. GROWTH AND SURVIVAL OF STRIPED BASS X WHITE PERCH HYBRIDS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:715-726. 1978[1979]. SFA 25(2)

[Va. Inst. Mar. Sci., Gloucester Point, VA 23062] Experiments comparing growth and survival of striped bass (*Morone saxatilis*) and striped bass female X white perch (*M. americana*) male hybrids indicated the hybrids were hardier than striped bass under the same experimental conditions. Striped bass exhibited health problems and resulting mortality which were not evident in the hybrids. Overall survival of striped bass in 2 replicate experiments was 42.5% agter 11 months, whereas that of the hybrids was 84.2%. Striped bass and hybrid growth patterns were similar, but striped bass grew more rapidly than the latter. Mean specific (instantaneous) growth rates were roughly similar throughout the study, with the major differences occurring during the first 4 months. At 17 months of age the mean hybrid fork length was 227.5 mm (range, 167 to 282 mm). This length was approximately equivalent to that of wild populations of white perch with 4 to 8 annuli and to that of mid-Atlantic striped bass with 2 annuli, but was substantially less than that of fresh-water and more southern populations. Hybrid length-weight equations were intermediate between those of striped bass and white perch. Salinity experiments demonstrated that both small (mean fork length, 43 mm) and large (mean fork length, 279 mm) hybrids can survive and grow for indefinite periods at salinities of 18 to 25 °/oo with no signs of stress. We believe that the hybrid may be suitable as a supplement to natural populations of striped bass and white perch in estuaries.

80-001354 Kingsley, M. C. S.; V. F. Gallucci and T. J. Quinn II. VON BERTALANFFY GROWTH PARAMETERS. *Trans. Am. Fish. Soc.* 109(2):252-253. Mar. 1980. SFA 25(2)

[Can. Wildl. Serv., 9942-108 St., Edmonton, AB T5K 2J5, Canada]

80-001355 Magnin, É. and A.-M. Clément. CROISSANCE ET RÉGIME ALIMENTAIRE DES MÉNOMINIS RONDS *PROSOPIUM CYLINDRACEUM* (PALLUS) DU TERRITOIRE DE LA BAIE JAMES. [GROWTH AND FOOD HABITS OF ROUND WHITEFISH *PROSOPIUM CYLINDRACEUM* (PALLAS) FROM THE JAMES BAY AREA.] *Nat. Can. (Que.)* 106(3):377-386. May-June 1979. In French with English summ. SFA 25(2)

[Dep. Sci. Biol., Univ. Montréal, C.P. 6128, Montréal, H3C 3J7, Canada] Ages were determined by examination of scales from 598 specimens of *Prosopium cylindraceum*: 93 from the lower part of the Grande riviére de la Baleine, 367 from the middle and lower reaches of the Grande Riviére and 138 from the upper parts of these two rivers and the adjacent Caniapiscau River. Growth in fork length and weight is very slow in

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80-001355 CONTINUED the Caniapiscau area, a little faster in La Grande Riviére and fastest in the Grande riviére de la Baleine: at age 10, 275 mm (206 g), 325 mm (355 g) and 344 mm (421 g) respectively. Round whitefish from the La Grande Riviére estuary fed mainly on insect larvae, principally those of Trichoptera and Diptera (Chironomidae).

80-001356 Mills, K. H. and R. J. Beamish. COMPARISON OF FIN-RAY AND SCALE AGE DETERMINATIONS FOR LAKE WHITEFISH (*COREGONUS CLUPEAFORMIS*) AND THEIR IMPLICATIONS FOR ESTIMATES OF GROWTH AND ANNUAL SURVIVAL. *Can. J. Fish. Aquatic Sci.* 37(3):534-544. Mar. 1980. SFA 25(2)
[Dep. Fish. Oceans, Freshwater Inst., Winnipeg, MB R3T 2N6, Canada]

80-001357 Narasimham, K. A. AGE AND GROWTH OF RIBBONFISH *TRICHIURUS LEPTURUS* LINNAEUS. *Indian J. Fish.* 23(1/2):174-182. 1976. SFA 25(2)
[Kakinada Res. Cent. C.M.F.R. Inst., Kakinada-533002, India] Age and growth of the ribbonfish *Trichiurus lepturus* Linnaeus is studied by length-frequency analysis of 20,562 fish measured during October 1965 to December 1970. The fish attains an average length of 41.6, 69.0 and 88.5 cm in 1st, 2nd, and 3rd years, respectively. The growth rate is fairly faster than what hitherto believed was to be. The von Bertalanffy growth equation is fitted, which has the parameters $L\infty$=145.4 cm, K=0.29 and t_0=-0.20 years. The length-at-age data obtained in this study compare favourably well with similar data on the same species from the northern Gulf of Mexico, East China Sea and Yellow Sea-Pohai Bay.

80-001358 Roff, D. A. A MOTION FOR THE RETIREMENT OF THE VON BERTALANFFY FUNCTION. *Can. J. Fish. Aquatic Sci.* 37(1):127-129. Jan. 1980. In English with French summ. SFA 25(2)
[Fish. Mar. Serv., P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

80-001359 Sanders, M. J. and D. G. M. Powell. COMPARISON OF THE GROWTH RATES OF TWO STOCKS OF SNAPPER (*CHRYSOPHRYS AURATUS*) IN SOUTH-EAST AUSTRALIAN WATERS USING CAPTURE-RECAPTURE DATA. *N.Z. J. Mar. Freshwater Res.* 13(2):279-284. 1979. SFA 25(2)
[Arthur Rylah Inst. Environ. Res., Fish. Wildl. Div., Minist. Conserv., Brown St., Heidelberg, Victoria, Australia 3084] Between 1957 and 1962, 4155 snapper, *Chrysophrys auratus* (Bloch & Schneider), were tagged and released at a number of sites in Victoria. By the end of June 1972, 210 had been recaptured, and knowing their lengths at release and recapture and the periods at liberty, we determined the von Bertalanffy growth parameters K and $L\infty$. The values (with 95% confidence limits) were: eastern stock - K = 0.071 ± 0.040, $L\infty$ = 968 ± 325 mm; western stock - K = 0.068 ± 0.023, $L\infty$ = 1079 ± 209 mm; combined stocks - K = 0.062 ± 0.019, $L\infty$ = 1119 ± 215 mm. No difference between the stocks was apparent when we compared the estimates of K and $L\infty$ separately; however, when the estimates of K and $L\infty$ were compared together, a Wilcoxon's test gave a significance probability of 1.5%, indicating a difference in growth rate between the stocks. For the range of lengths of snapper recaptured, this difference was evidently caused by faster growth of snapper from the western stock.

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80-001360 Schmitt, D. N. and W. A. Hubert. COMPARISON OF TWO AGING TECHNIQUES FOR YELLOW PERCH. *Proc. Iowa Acad. Sci.* 87(1):12. Mar. 1980. Abstract only. SFA 25(2)

[Iowa Coop. Fish. Res. Unit, Iowa State Univ., Ames 50011] Estimating fish population parameters from age and growth data is dependent upon the precision of age determination. Assessment of the precision of aging techniques utilizing body scales and cleithral bones was conducted on a sample of 100 yellow perch, (*Perca flavescens*), from West Okoboji Lake, Iowa. Regressions on total length using scale and cleithral measurements were compared and backcalculation of annual mean lengths were computed. Aging methods agreed on 95 percent of the sample. Cleithral bones were useful in substantiating scale readings from acetate impressions, but did not significantly improve precision of aging. Extra time needed for collection and preparation of cleithra and the necessary sacrifice of sampled perch probably limits applicability of the cleithral method.

80-001361 Short, D. W. and B. J. Davis. PRELIMINARY OBSERVATIONS OF AGE AND GROWTH BY *POMOXIS ANNULARIS* AND *P. NIGROMACULATUS* IN NORTH LOUISIANA. *Proc. La. Acad. Sci.* 42:84. 1979. Abstract only. SFA 25(2)

[La. Polytech. Univ., Ruston]

80-001362 Shust, K. V. and I. A. Pinskaya. AGE AND RATE OF GROWTH OF SIX SPECIES OF NOTOTHENID FISH (FAMILY NOTOTHENIIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):743-749. 1978. SFA 25(2)

[VNIRO, Moscow, USSR]

80-001363 Timmons, T. J.; W. L. Shelton and W. D. Davis. DIFFERENTIAL GROWTH OF LARGEMOUTH BASS IN WEST POINT RESERVOIR, ALABAMA-GEORGIA. *Trans. Am. Fish. Soc.* 109(2):176-186. Mar. 1980. SFA 25(2)

[Ala. Coop. Fish. Res. Unit, Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830]

80-001364 Weatherley, A. H.; H. S. Gill and S. C. Rogers. GROWTH DYNAMICS OF MUSCLE FIBRES, DRY WEIGHT, AND CONDITION IN RELATION TO SOMATIC GROWTH RATE IN YEARLING RAINBOW TROUT (*SALMO GAIRDNERI*). *Can. J. Zool.* 57(12):2385-2392. Dec. 1979. In English with French summ. SFA 25(2)

[Life Sci. Div., Scarborough Coll., Univ. Toronto, West Hill, ON M1C 1A4, Canada] Rainbow trout (15.5 cm) fed "ad lib." rations grew a little faster at 12°C than at 16°C, and both groups grew much faster than a third group at 12°C receiving "3-4%" rations. Growth of the mosaic muscle mass was characterized by increase in fibre mean diameter, though most bulk increase (up to 25 cm or more) resulted from increase in fibre number. Fibre diameter: fish length was least in the fastest growing trout (12°C ad lib.), signifying their greater ability to add new fibres during growth compared with the slower growing trout; diameter range increased markedly among trout >18 cm long, but small fibres (<20μm) persisted in diminishing numbers even in the largest trout. In the 12°C ad lib. trout, condition (K) correlated with length and fibre diameter; in the slower growing groups K was more influenced by mean fibre diameter. A higher asymptote of K occurred at greater length in the fastest growing group than in the two slower growing groups. Percent dry weight:length was greater for 16°C ad lib. than for the fastest or slowest growth groups; absolute dry weight:length ratios were similar for 12°C and 16° ad lib. trout; both exceeded those for the 12°C 3-4% group.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001365 Adkins, G.; J. Tarver; P. Bowman and B. Savoie. A STUDY OF THE COMMERCIAL FINFISH IN COASTAL LOUISIANA. *La. Dep. Wildl. Fish. Tech. Bull.* No. 29. viii + 87p. July 1979. SFA 25(2)

80-001366 Anonymous. ENDEMIC FISHES OF THE COLORADO RIVER SYSTEM A STATUS REPORT. *Colo. River Wildl. Counc. Publ.* 16p. 1 May 1977. SFA 25(2)

80-001367 Baranes, A. and A. Ben-Tuvia. TWO RARE CARCHARHINIDS, *HEMIPRISTIS ELONGATUS* AND *IAGO OMANENSIS*, FROM THE NORTHERN RED SEA. *Isr. J. Zool.* 28(1):39-50. 1979. SFA 25(2)

[Dep. Zool., Hebrew Univ. Jerusalem, Jerusalem, Israel] Two rare species of sharks of the family Carcharhinidae have been collected in the Gulf of Elat (= Gulf of 'Aqaba), northern Red Sea. A description of *Hemipristis elongatus* (Klunzinger, 1871) is based on one specimen, with additional data based on a specimen collected in the Gulf of Oman; a description of *Iago omanensis* (Norman, 1939) is based on four specimens caught at a depth of 500-1000 m. This is the first record of this species from the Red Sea although it seems that photographs of specimens resting on the bottom at great depths were published by Marshall and Bourne in 1964.

80-001368 Bohnsack, J. A. RESOLUTION OF THE ORDER VERSUS CHAOS CONTROVERSY CONCERNING REEF FISH COMMUNITY STRUCUTRE IN TERMS OF ISLAND BIOGEOGRPAHIC THEORY. *Fla. Sci.* 43(Suppl. 1):23. 1980. Abstract only. SFA 25(2)

[Dep. Biol., Univ. Miami, Coral Gables, FL 33155] Two prominent schools have developed concerning reef fish community structure. According to the order (deterministic) school, reef fishes have evolved precise habitat requirements which reduce competition for limited resources. This results in reef fish communities that tend to be stable through time. According to the chaos (Stochastic) school, reef fish communities are quite unstable in structure because of high mortality rates which are largely determined by chance processes. Data on reef fish turnover rates collected from model and natural coral heads in the Florida Keys over 3 years suggest that the dichotomy of views is an artifact of interval between samples and can be accounted for in terms of island biogeographic theory. The Y-intercept of the log of estimated turnover rate versus the log of time between samples is suggested as an objective basis for comparing turnover rates.

80-001369 Briggs, P. T.; C. S. Zawacki and F. M. Mushacke. NOTES ON FISHES RARE IN THE WATERS OFF THE SOUTH SHORE OF LONG ISLAND. *N.Y. Fish Game J.* 26(2):195-197. July 1979. SFA 25(2)

[State Univ. N.Y., Environ. Conserv., Bldg. 40, Stony Brook 11794]

80-001370 Campbell, R. N. and R. B. Williamson. THE FISHES OF INLAND WATERS IN THE OUTER HEBRIDES. *Proc. R. Soc. Edinburgh Sect. B Biol. Sci.* 77:377-393. 1979. SFA 25(2)

[Nat. Conserv. Council, Fraser Darling House, Inverness, Scotland]

80-001371 Carlson, C. A.; C. G. Prewitt; D. E. Snyder; E. J. Wick; E. L. Ames and W. D. Fronk. FISHES AND MACROINVERTEBRATES OF THE WHITE AND YAMPA RIVERS, COLORADO. *U.S. Dep. Interior Bur. Land Manage. (Colo.) Biol. Sci. Ser.* No. 1. ix + 276p. Feb. 1979. SFA 25(2)

[Dep. Fish. Wildl. Biol., Colo. State Univ., Fort Collins 80523]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001372 Carlson, H. R. SEASONAL DISTRIBUTION AND ENVIRONMENT OF PACIFIC HERRING NEAR AUKE BAY, LYNN CANAL, SOUTHEASTERN ALASKA. *Trans. Am. Fish. Soc.* 109(1):71-78. Jan. 1980. SFA 25(2)
[NMFS, P.O. Box 155, Auke Bay, AK 99821]

80-001373 Clark, T. FISHES OF THE MOUTH OF WOLF RIVER, DONIPHAN COUNTY, KANSAS. *Trans. Kans. Acad. Sci.* 82:188-193. 1979. SFA 25(2)
[Bendena, KS 66008]

80-001374 Comp, G. S. PATTERNS OF SEASONALITY AND RELATIVE ABUNDANCE OF FISHES IN EASTERN TAMPA BAY. *Fla. Sci.* 43(Suppl. 1):25. 1980. Abstract only. SFA 25(2)
[Mote Mar. Lab., 1600 City Island Park, Sarasota, FL 33577]

80-001375 Davis, J. R. REDISCOVERY, DISTRIBUTION, AND POPULATIONAL STATUS OF *CYPRINODON EXIMIUS* (CYPRINODONTIDAE) IN DEVIL'S RIVER, TEXAS. *Southwest. Nat.* 25(1):81-88. 30 Jan. 1980. SFA 25(2)
[Tex. Dep. Water Resour., P.O. Box 13087, Capitol Stn., Austin 78711] Recent collections of *Cyprinodon eximius* from Devil's River, the first in 10 years, have dispelled reports of its extinction there. However, populational status is precarious due to severe habitat loss and range restriction. Distributional data and ongoing morphological observations suggest that two allopatric populations once inhabited the river. A population that once occurred above Dolan Falls is now extinct, apparently a victim of a series of catastrophic events in the mid-1950's. A second population originally inhabited lower Devil's River and an immediately adjacent portion of the Rio Grande, but the filling of Amistad Reservoir in 1968 inundated over 75% of that reach. Now, only a remnant of the second population survives, restricted to a 10.9 km reach above Amistad Reservoir.

80-001376 Fiske, J. D.; C. E. Watson and P. G. Coates. A STUDY OF THE MARINE RESOURCES OF PLEASANT BAY. *Mass. Dep. Nat. Resour. Div. Mar. Fish. Monogr. Ser.* No. 5. iii + 56p. May 1967. SFA 25(2)

80-001377 Friedman, B. and C. T. Hamilton. THE FISH LIFE OF UPPER NEW YORK BAY. *Underwater Nat.* 12(2):18-21. 1980. SFA 25(2)
[Texas Instruments, Buchanan, NY]

80-001378 Galzin, R. LA FAUNE ICHTHYOLOGIQUE D'UN RECIF CORALLIEN DE MOOREA, POLYNESIE FRANÇAISE: ECHANTILLONNAGE ET PREMIERS RESULTATS. [THE FISH COMMUNITY OF A CORAL RÉEF OF MOOREA, FRENCH POLYNESIA: SAMPLING TECHNIQUES AND PRELIMINARY RESULTS.] *Terre Vie* 33(4):623-643. Oct.-Dec. 1979. In French with English summ. SFA 25(2)
[Antenne Mus. Hautes Etudes, B.P. 562 Papeete, Tahiti]

80-001379 Gosselink, J. G.; C. L. Cordes and J. W. Parsons. AN ECOLOGICAL CHARACTERIZATION STUDY OF THE CHENIER PLAIN COASTAL ECOSYSTEM OF LOUISIANA AND TEXAS. VOLUME I. NARRATIVE REPORT. *U.S. Fish Wildl. Serv.* FWS/OBS-78/9. xxiv + 302p. Aug. 1979. SFA 25(2)
[Cent. Wetland Resour., La. State Univ., Baton Rouge 70803]

80-001380 Gosselink, J. G.; C. L. Cordes and J. W. Parsons. AN ECOLOGICAL CHARACTERIZATION STUDY OF THE CHENIER PLAIN COASTAL ECOSYSTEM OF LOUISIANA AND TEXAS. VOLUME II. APPENDIXES. *U.S. Fish Wildl. Serv.* FWS/OBS-78/10.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001380 CONTINUED ix + 407p. Aug. 1979. SFA 25(2)
[Cent. Wetland Resour., La. State Univ., Baton Rouge 70803]

80-001381 Gosselink, J. G. AN ECOLOGICAL CHARACTERIZATION STUDY OF THE CHENIER PLAIN COASTAL ECOSYSTEM OF LOUISIANA AND TEXAS. VOLUME III. ATLAS. *U.S. Fish Wildl. Serv.* FWS/OBS-78/11. Aug. 1979. SFA 25(2)
[Cent. Wetland Resour., La. State Univ., Baton Rouge 70803]

80-001382 Guillory, V. A POSSIBLE EXPLANATION FOR THE ABSENCE OF ENDEMIC FISHES IN LOUISIANA. *Fla. Sci.* 42(4):253-255. 1979. SFA 25(2)
[Fla. Game Fresh Water Fish Comm., P.O. Box 1903, Eustis 32726] The absence of endemic Louisiana fishes may be attributed to historical and physiographic factors. The periodic inundation of the Mississippi Embayment by the Gulf of Mexico during early Pleistocene interglacial periods obliterated the freshwater ichthyofauna. Afterwards, the ample dispersal mechanisms available prevented isolation and subsequent speciation of fishes in Louisiana.

80-001383 Guillory, V. DISTRIBUTIONAL NOTES ON SOME LOWER MISSISSIPPI RIVER FISHES. *Fla. Sci.* 42(4):248-250. 1979. SFA 25(2)
[Fla. Game Fresh Water Fish Comm., P.O. Box 1903, Eustis 32726] The fishes were collected for the first time in Louisiana during recent ecological investigations in the Mississippi River. The known ranges of *Hybopsis gelida*, *H. meekei* and *Noturus flavus* were extended 1125, 642, and 370 river km, respectively.

80-001384 Guillory, V.; C. H. Hocutt and J. R. Stauffer, Jr. ENDANGERED FRESHWATER FISHES OF THE SOUTHEASTERN UNITED STATES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:703-714. 1978[1979]. SFA 25(2)
[La. Dep. Wildl. Fish., P.O. Box 37, Grand Isle] Endangered native freshwater fishes are catalogued for 16 southeastern states. The status of each of the 356 species is included at the national, regional, or state levels. A standardized list of categories (endangered; threatened; special concern - national; special concern - state; extirpated) and definitions are suggested for use in state programs. Further recommendations are made to base programs on the state level on sound and manageable endangered species checklists.

80-001385 Hadley, W. F. and K. Clulow. FIRST RECORD OF THE FALLFISH FROM THE LAKE ERIE DRAINAGE OF NEW YORK. *N.Y. Fish Game J.* 26(2):192-193. July 1979. SFA 25(2)
[Dep. Biol., State Univ. N.Y., Buffalo]

80-001386 Halliwell, D. B. A LIST OF THE FRESHWATER FISHES OF MASSACHUSETTS. *Mass. Div. Fish. Wildl. Fauna Mass. Ser.* No. 4. 13p. 1979. SFA 25(2)

80-001387 Hastings, R. W. THE ORIGIN AND SEASONALITY OF THE FISH FAUNA ON A NEW JETTY IN THE NORTHEASTERN GULF OF MEXICO. *Bull. Fla. State Mus. Biol. Sci.* 24(1):1-124. 1979. SFA 25(2)
[Dep. Biol., Rutgers Univ., Camden, NJ]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

80-001388 Hempel, G.; D. Sahrhage; W. Schreiber and R. Steinberg. ANTARKTIS-EXPEDITION 1977/78 DER BUNDESREPUBLIK DEUTSCHLAND. [ANTARCTIC EXPEDITION 1977/78 OF THE FEDERAL REPUBLIC OF GERMANY.] *Arch. Fischereiwiss.* 30(1):1-119. Oct. 1979. In German with English summ. SFA 25(2)
[Inst. Meereskd., Univ. Kiel, West Germany]

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[Va. Inst. Mar. Sci., Gloucester Point 23062] A seining survey of the fish fauna of the beach zone in the James River, Virginia, was conducted from July to December 1977. Weekly collections were made at 4 stations resulting in the capture of 17,602 individuals representing 36 species. Abundance and diversity were influenced by large catches of schooling and migratory species utilizing nearshore areas as a nursery ground. Freshwater species diversity peaked in August and September, while mesohaline species diversity peaked in July, September, and November. Cluster analysis was used to define 3 freshwater station groups representing warm, moderate, and cool water temperatures, but was not helpful in analyzing mesohaline stations.

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[Coll. Mar. Stud., Univ. Del., Newark]

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[U.S. FWS, 1311 Federal Bldg., Salt Lake City, UT 84138]

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GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

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80-001409 Murty, A. V. S. and M. N. Vishnudatta. THE SEASONAL DISTRIBUTION OF SOME OCEANOGRAPHIC PARAMETERS OFF SOUTHWEST COAST OF INDIA RELEVANT TO PELAGIC FISHERIES. *Indian J. Fish.* 23(1/2):97-104. 1976. SFA 25(2)
[Cent. Mar. Fish. Res. Inst., Cochin-682018, India] The temperature, salinity and oxygen distributions associated with the thermocline of the shelf and adjacent waters off the southwest coast of India are presented seasonwise. The seasonal differences in the location of the thermocline and the magnitude of the vertical temperature gradient within the thermocline are also presented and discussed. The commercially important pelagic fisheries of the waters are also discussed in the light of environmental conditions.

80-001410 Nair, R. V. and R. Soundararajan. ON THE OCCURRENCE OF THE STING RAY *DASYATIS (DASYATIS) MICROPS* (ANNANDALE) ON THE MADRAS COAST AND IN THE GULF OF MANNAR. *Indian J. Fish.* 23(1/2):273-277. 1976. SFA 25(2)
[Mandapam Reg. Cent. C.M.F.R. Inst., Mandapam Camp, India]

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[Brackishwater Aquacult. Dev. Cent., Jepara, Indonesia] The intensive culture of milkfish in brackishwater ponds in Indonesia is faced by the problem of the availability of fry for stocking. These milkfish fry are gathered from natural waters along the coast of certain islands in Indonesia. A survey was conducted to known fry collecting centres including search for new fry grounds in South Sumatra. This paper reviews the status of occurrence of milkfish fry in Indonesia. The channels of fry marketing are also discussed.

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[Va. Inst. Mar. Sci., Gloucester Point 23062]

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[La. Dep. Wildl. Fish., Grand Chenier 70643]

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80-001418 Phillips, T. D. SEASONAL DISTRIBUTION AND RELATIVE ABUNDANCE OF ICHTHYOPLANKTON IN LOWER HILLSBOROUGH BAY, FLORIDA. *Fla. Sci.* 43(Suppl. 1):25. 1980. Abstract only. SFA 25(2)
[Mote Mar. Lab., 1600 City Island Park, Sarasota, FL 33577] Ichthyoplankton was collected at ten stations in lower Hillsborough Bay from January 1976 through March 1977. Forty one species of larvae representing twenty two families and eggs representing twelve families were identified and counted. Engraulid larvae, primarily those of *Anchoa mitchilli* and *A. hepsetus* constituted 87% of all larvae collected. Eggs of the Engraulids and Sciaenids accounted for 73% and 26% respectively, of all eggs collected. Eggs and larvae were collected during all months of the study. Ichthyoplankton was most abundant between March and October with a noticeable decline in numbers in the middle of the summer and only low numbers were collected through the winter months. Engraulids and sciaenids were dominant during spring and summer and were replaced in the winter by larvae of *Brevoortia* sp., *Gobiesox strumosus*, *Hypsoblennius hentzi* and several species of gobies.

80-001419 Potter, W. A.; K. L. Dickson and L. A. Nielsen. LARVAL SPORT FISH DRIFT IN THE NEW RIVER. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:672-679. 1978[1979]. SFA 25(2)
[Ecol. Sci. Div., NUS Corp., Pittsburg, PA 15220] Abundance of larval sport fishes in the New River, at Glen Lyn, VA, was calculated from catch volume of water sampled through drift nets, and daily river discharge for the period June through August 1976. The estimates of larval sport fish drift included 2,410,000 channel catfish (*Ictalurus punctatus*), 162,000 flathead catfish (*Pylodictis olivaris*), 106,000 rock bass (*Ambloplites rupestris*), 46,900 smallmouth bass (*Micropterus dolomieu*), and 125,000 spotted bass (*M. punctulatus*). The seasonal distribution and occurrence of larvae were comparable to literature reports. Drift sampling may be an effective technique for estimating the absolute abundance of fish at an early developmental stage. These estimates may give fisheries managers the lead time necessary for implementation of effective management strategies in large river systems where it is difficult to sample later life stages quantitatively.

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[Waltair Res. Cent. Cent. Mar. Fish. Res. Inst., Waltair, India]

80-001422 Russell, J. A. THE OCCURRENCE OF THE WESTERN MOSQUITO FISH (*GAMBUSIA AFFINIS AFFINIS*) IN IOWA. *Proc. Iowa Acad. Sci.* 87(1):24. Mar. 1980. Abstract only. SFA 25(2)
[Walford, IA 52351] The western mosquito fish (*Gambusia affinis affinis*) was discovered in Lee county, Iowa during seining of various habitats. It occupied the margins of overflow pools of the Mississippi river south of Ft. Madison. It is common in Missouri and Illinois and was expected to be found in southeastern Iowa because of the wide avenue for species dispersal from the south provided by the Mississippi river. This fish was abundant in the area where it was collected, but appeared absent from similar habitat farther south along the river. Additional study must be made to determine whether this population has been introduced or represents a peripheral population.

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80-001424 Southward, A. J. and A. D. Mattacola. OCCURRENCE OF NORWAY POUT, *TRISOPTERUS ESMARKI* (NILSSON) AND BLUE WHITING, *MICROMESISTIUS POUTASSOU* (RISSO), IN THE WESTERN ENGLISH CHANNEL OFF PLYMOUTH. *J. Mar. Biol. Assoc. UK* 60(1):39-44. Feb. 1980. SFA 25(2)
[Mar. Biol. Assoc., Citadel Hill, Plymouth, England]

80-001425 Sreenivasan, P. V. RECORDS OF SIX SPECIES OF CARANGIDS FROM THE SOUTHWEST COAST OF INDIA. *Indian J. Fish.* 23(1/2):41-56. 1976. SFA 25(2)
[Porto Novo Field Cent. C.M.F.R.I., Porto Novo 608502, India]

80-001426 Stein, D. L. OCCURRENCE OF *BATHYLACO NIGRICANS* (PISCES, ALEPOCEPHALIDAE) OFF THE COAST OF OREGON. *Syesis* 11:281. 1978. SFA 25(2)
[Sch. Oceanogr., Oreg. State Univ., Corvallis 97331]

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[VNIRO, Moscow, USSR]

80-001428 Tabeta, O. and T. Ozawa. ANGUILLID LEPTOCEPHALI FROM THE EASTERN INDIAN OCEAN. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1069-1073. Sept. 1979. SFA 25(2)
[Dep. Aquacult. Biol., Shimonoseki Univ. Fish., Yoshima, Shimonoseki 759-65, Japan]

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[Mar. Resour. Res. Inst., S.C. Wildl. Mar. Resour. Dep., Charleston 29412]

80-001430 White, A. M. and N. A. Alldridge. DISTRIBUTION OF EARLY FISH LARVAL STAGES IN THE LOWER CHAGRIN RIVER AND ADJACENT LAKE ERIE BEACHES. *Ohio J. Sci.* 80:13. 1980. Abstract only. SFA 25(2)
[John Carroll Univ., Cleveland, OH]

80-001431 Wilkens, H. REDUKTIONSGRAD UND PHYLOGENETISCHES ALTER: EIN BEITRAG ZUR BESIEDLUNGSGESCHICHTE DER LIMNOFAUNA YUKATANS. [REGRESSIVE EVOLUTION AND PHYLOGENETIC AGE: THE HISTORY OF COLONIZATION OF FRESHWATERS OF YUCATAN BY FISH AND CRUSTACEA.] *Z. Zool. Syst. Evolutionsforsch.* 17(4):262-272. Dec. 1979. In German with English summ. SFA 25(2)
[Zool. Inst., Martin-Luther-King-Platz 3, D-2000 Hamburg 13, West Germany]

80-001432 Willan, R. C.; J. M. Dollimore and J. Nicholson. A SURVEY OF FISH POPULATIONS AT KARIKARI PENINSULA, NORTHLAND, BY SCUBA DIVING. *N.Z. Mar. Freshwater Res.* 13(3):447-458. 1979. SFA 25(2)
[Zool. Dep., Univ. Auckland, Private Bag, Auckland, New Zealand] Census data for fishes observed by scuba divers at selected sites on the east coast of Karikari Peninsula, Northland, are given qualitatively in a checklist. Sixty-four species in 33 families were recorded. Significant new records were those for surgeonfish (*Prionurus maculatus* Ogilby) and rainbow parrotfish (*Suezichthys* sp.). A system for quantification of densities by an underwater transect technique is presented and results are given for three sites; this method could be used by amateur divers to obtain data on the status and structure of coastal reef fish populations in New Zealand. A standardised transect procedure for divers to follow to obtain comparable results is given.

80-001433 Wilson, D. E. and G. W. Hughes. THE FIRST RECORD OF THE BROWN CAT SHARK, *APRISTURUS BRUNNEUS* (GILBERT, 1891) FROM ALASKAN WATERS. *Syesis* 11:283. 1978. SFA 25(2)
[Dep. Fish. Environ., Technol. Inspection Dir., Prince Rupert, BC V8J 1G8, Canada]

80-001434 Wydoski, R. S. and R. R. Whitney. INLAND FISHES OF WASHINGTON. *Univ. Wash. Press, Seattle* xxxii + 220p. 1979. SFA 25(2)

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

80-001435 Borawa, J. C.; J. H. Kerby; M. T. Huish and A. W. Mullis. CURRITUCK SOUND FISH POPULATIONS BEFORE AND AFTER INFESTATION BY EURASIAN WATER-MILFOIL. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:520-528. 1978[1979]. SFA 25(2)
[N.C. Wildl. Resour. Comm., 512 N. Salisbury St., Raleigh 27611] Data collected from rotenone samples of 3 coves before (1959-65) and after (1977) infestation by Eurasian water-milfoil (*Myriophyllum spicatum*) were compared to document changes in the fish populations. Using the mean of the 3 areas for comparison, both weight and number per hectare increased after

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80-001435 CONTINUED water-milfoil infestation. The average weight per individual decreased from 0.02 kg (1959-65) to 0.008 kg (1977). The species were separated into 7 groups. Six of the groups had higher mean numbers per hectare and all groups had higher mean weights per hectare. Multivariate analyses of variance showed that the population structure had changed for numbers and weights per hectare. Ictalurids and yellow perch (*Perca flavescens*) had the greatest proportionate increases in numbers, whereas largemouth bass (*Micropterus salmoides*) and white perch (*Morone americana*) had the greatest proportionate decreases. Ictalurids and centrarchids, other than largemouth bass, exhibited the greatest proportionate increases in weights per hectare, while largemouth bass and other fish showed the greatest proportionate decreases. Numbers of young-of-the-year and older largemouth bass per hectare were not significantly different between pre- and post-water-milfoil samples.

80-001436 Burrough, R. J.; P. R. Bregazzi and C. R. Kennedy. INTERSPECIFIC DOMINANCE AMONGST THREE SPECIES OF COARSE FISH IN SLAPTON LEY, DEVON. *J. Fish Biol.* 15(5):535-544. Nov. 1979. SFA 25(2)
[Imperial Coll. Cent. Environ. Technol., 48 Prince's Gardens, London SW7 2PE, England] Marked changes in the relative numbers of roach *Rutilus rutilus* (L.), rudd *Scardinius erythrophthalmus* (L.) and perch *Perca fluviatilis* L., in Slapton Ley, Devon, have been observed over the period 1967-1978. Historically, the lake had been dominated by rudd and perch; significant numbers of roach were not thought to be present until 1967. From then onwards the roach population exhibited a considerable expansion, apparently replacing the rudd, which had virtually disappeared by 1974. In 1975 extensive mortalities of roach were caused by the pseudophyllidean cestode *Ligula intestinalis* L. During 1976 and 1977 larger numbers of rudd, belonging to the 1975 and 1976 year classes, were present, suggesting that the roach mortalities might be giving the rudd a chance to recover. However, very few rudd were present during 1978, possibly because lower incidences of ligulosis during 1976-1978 had allowed the roach to recover from the main outbreak of the disease in 1975, and to replace the rudd for the second time. Evidence from trap catches indicated that the perch population had shown a consistent decline between 1970 and 1977. The major phase of this decrease occurred between 1971 and 1973, when the roach population was increasing the most rapidly. Comparisons were made with changes in fish populations in other localities. The major reason for the changes observed was thought to be a competitive relationship between the plankton feeding younger stages, with roach being the dominant species, although other factors may also have been involved.

80-001437 Hayman, R. A. and A. V. Tyler. ENVIRONMENT AND COHORT STRENGTH OF DOVER SOLE AND ENGLISH SOLE. *Trans. Am. Fish. Soc.* 109(1):54-70. Jan. 1980. SFA 25(2)
[Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331]

80-001438 Shuter, B. J.; J. A. MacLean; F. E. J. Fry and H. A. Regier. STOCHASTIC SIMULATION OF TEMPERATURE EFFECTS ON FIRST-YEAR SURVIVAL OF SMALLMOUTH BASS. *Trans. Am. Fish. Soc.* 109(1):1-34. Jan. 1980. SFA 25(2)
[Inst. Environ. Stud., Univ. Toronto, Box 50, Maple, ON L0J 1E0, Canada]

80-001439 Stauffer, T. M. TWO-YEAR CYCLES OF ABUNDANCE OF AGE-0 RAINBOW TROUT IN LAKE SUPERIOR TRIBUTARIES. *Trans. Am. Fish. Soc.* 108(6):542-547. Nov. 1979. SFA 25(2)
[Marquette Fish. Res. Stn., Mich. Dep. Nat. Resour., Marquette 49855]

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

80-001440 Taylor, S. G. MARINE SURVIVAL OF PINK SALMON FRY FROM EARLY AND LATE SPAWNERS. *Trans. Am. Fish. Soc.* 109(1);79-82. Jan. 1980. SFA 25(2)
[NMFS, P.O. Box 155, Auke Bay, AK 99821]

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80-001441 Svärdson, G. SPECIATION OF SCANDINAVIAN *COREGONUS*. *Inst. Freshwater Res. Drottningholm Rep.* No. 57. 95p. 1979. SFA 25(2)
[Inst. Freshwater Res., S-179 11 Drottningholm, Sweden]

80-001442 Anderson, W. D., Jr. and P. C. Heemstra. TWO NEW SPECIES OF WESTERN ATLANTIC *ANTHIAS* (PISCES: SERRANIDAE), REDESCRIPTION OF *A. ASPERILINGUIS* AND REVIEW OF *HOLANTHIAS MARTINICENSIS*. *Copeia* 1980(1):72-87. 1 Feb. 1980. SFA 25(2)
[Grice Mar. Biol. Lab., Coll. Charleston, 205 Fort Johnson, Charleston, SC 29412]

80-001443 Au, K.-C. SYSTEMATIC STUDY ON THE BARRACUDAS (PISCES: SPHYRAENIDAE) FROM A NORTHERN SECTOR OF THE SOUTH CHINA SEA. *J. Nat. Hist.* 13(5):619-647. Sept.-Oct. 1979. SFA 25(2)
[Mar. Sci. Lab., Chinese Univ. Hong Kong, Shatin, Hong Kong]

80-001444 Bennett, D. K. THREE LATE CENOZOIC FISH FAUNAS FROM NEBRASKA. *Trans. Kans. Acad. Sci.* 82:146-177. 1979. SFA 25(2)
[Mus. Nat. Hist., Univ. Kans., Lawrence 66045]

80-001445 Castle, P. H. J. IDENTIFICATION OF *CONGROGADUS MARGINATUS* FROM HAWAII WITH THE EEL GENUS *ARIOSOMA* (PISCES: CONGRIDAE). *Copeia* 1980(1):159-160. 1 Feb. 1980. SFA 25(2)
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80-001446 Fedorov, V. V. and A. V. Neyelov. A NEW GENUS AND SPECIES OF EELPOUT, *ANDRIASHEVIA APTERA* (PERCIFORMES, ZOARCIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):846-850. 1978. SFA 25(2)
[Zool. Inst. USSR Acad. Sci., Leningrad, USSR]

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[Dep. Nat. Resour., Cornell Univ., Ithaca, NY 14853]

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[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109]

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[Dep. Zool., Br. Mus. (Nat. Hist.), Cromwell Rd., London SW7 5BD, England]

80-001451 Hubbs, C. L. and R. L. Wisner. REVISION OF THE SAURIES (PISCES, SCOMBERESOCIDAE) WITH DESCRIPTIONS OF TWO NEW GENERA AND ONE NEW SPECIES. *NOAA Fish Bull.* 77(3):521-566. July 1979. SFA 25(2)
[R. L. Wisner: Scripps Inst. Oceanogr., La Jolla, CA 92093]

80-001452 Kondjurin, V. V. and N. A. Myagkov. ON TAXONOMIC STATUS OF *SQUALUS ACUTIPINNIS* REGAN, 1908 (SQUALIDAE, SQUALIFORMES) FROM THE SOUTH AFRICAN WATERS. *Zool. Zh.* 58(10):1604-1606. Oct. 1979. In Russian with English summ. SFA 25(2)
[Higlier Eng. Mar. Coll., Kaliningrad, USSR]

80-001453 Kotlyar, A. N. A CONTRIBUTION TO THE SYSTEMATICS OF "ARMLESS" FLOUNDERS (PISCES, BOTHIDAE) FROM THE SOUTH-WESTERN ATLANTIC. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):708-721. 1978. SFA 25(2)
[VNIRO, Moscow, USSR] On the basis of specimens collected in the South-western Atlantic a morphological description is given of three genera and three species of left-handed flounder. A new genus and a new subspecies are described.

80-001454 Markle, D. F. and N. R. Merrett. THE ABYSSAL ALEPOCEPHALID, *RINOCTES NASUTUS* (PISCES: SALMONIFORMES), A REDESCRIPTION AND AN EVALUATION OF ITS SYSTEMATIC POSITION. *J. Zool. (Lond.)* 190(2):225-239. Feb. 1980. SFA 25(2)
[Huntsman Mar. Lab., St. Andrews, NB E0G 2X0, Canada]

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[Huntsman Mar. Lab., St. Andrews, NB E0G 2X0, Canada]

80-001456 Matthews, F. D. *COTTUS GIRARDI* (PISCES: COTTIDAE), A VALID SPECIES. *Copeia* 1980(1):158-159. 1 Feb. 1980. SFA 25(2)
[Dep. Biochem., Med. Univ. S.C., Charleston 29401]

80-001457 Merrett, N. R. *BATHYTYPHLOPS SEWELLI* (PISCES: CHLOROPHTHALMIDAE) A SENIOR SYNONYM OF *B. AZORENSIS*, FROM THE EASTERN NORTH ATLANTIC WITH NOTES ON ITS BIOLOGY. *Zool. J. Linn. Soc.* 68(2):99-109. Feb. 1980. SFA 25(2)
[Inst. Oceanogr. Sci., Brook Rd., Wormley, Godalming, Surrey GU8 5UB, England]

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80-001459 Nelson, J. S. REVISION OF THE FISHES OF THE NEW ZEALAND GENUS *HEMEROCOETES* (PERCIFORMES: PERCOPHIDIDAE), WITH DESCRIPTIONS OF TWO NEW SPECIES. *N.Z. J. Zool.* 6(4):587-599. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. Alberta, Edmonton, AB T6G 2E9, Canada]

80-001460 Parin, N. V. and A. W. Ebeling. A NEW WESTERN PACIFIC *POROMITRA* (PISCES: MELAMPHAIDAE). *Copeia* 1980(1):87-93. 1 Feb. 1980. SFA 25(2)
[P. P. Shirshov Inst. Oceanol., Acad. Sci. USSR, 23 Krasikova, Moscow 117218, USSR]

80-001461 Paulin, C. D. and J. M. Moreland. *CONGIOPODUS CORIACEUS*, A NEW SPECIES OF PIGFISH, AND A REDESCRIPTION OF *C. LEUCOPAECILUS* (RICHARDSON), FROM NEW ZEALAND (PISCES: CONGIOPODIDAE). *N.Z. J. Zool.* 6(4):601-608. Dec. 1979. SFA 25(2)
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80-001462 Peden, A. E. A SYSTEMATIC REVISION OF THE HEMILEPIDOTINE FISHES (COTTIDAE). *Syesis* 11:11-49. 1978. SFA 25(2)
[British Columbia Prov. Mus., Victoria, BC V8W 1X4, Canada]

80-001463 Ragimov, D. B. ON THE SYSTEMATIC STATUS OF SOME SPECIES OF THE GENUS *BENTHOPHILUS* (FAMILY GOBIIDAE) FROM THE CASPIAN SEA AND THE SEA OF AZOV. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):701-708. 1978. SFA 25(2)
[Caspian Biol. Stn., Inst. Zool., Azerbaydzhan SSR Acad. Sci., Baku, USSR]

80-001464 Richards, W. J. and V. P. Saksena. *TRIGLA (TRIGLOPORUS) AFRICANA* SMITH, A SYNONYM OF *CHELIDONICHTHYS LASTOVIZA* (BONNATERRE) (PISCES: TRIGLIDAE). *Copeia* 1980(1):156-157. 1 Feb. 1980. SFA 25(2)
[NMFS, 75 Virginia Beach Dr., Miami, FL 33149]

80-001465 Richardson, S. L. and B. B. Washington. GUIDE TO IDENTIFICATION OF SOME SCULPIN (COTTIDAE) LARVAE FROM MARINE AND BRACKISH WATERS OFF OREGON AND ADJACENT AREAS IN THE NORTHEAST PACIFIC. *NOAA Tech. Rep. NMFS Circ.* 430:iv + 56p. Jan. 1980. SFA 25(2)
[Gulf Coast Res. Lab., East Beach Dr., Ocean Springs, MS 39564]

80-001466 Seshappa, G. REPORT ON A COLLECTION OF TONGUE SOLES (*CYNOGLOSSUS* SPP.) FROM MOPLAH BAY WITH A DESCRIPTION OF *C. LIDA* (BLEEKER). *Indian J. Fish.* 23(1/2):160-173. 1976. SFA 25(2)
[Calicut Res. Cent. C.M.F.R. Inst., Kozhikode, India]

80-001467 Smith, P. J.; B. A. Wood and P. G. Benson. ELECTROPHORETIC AND MERISTIC SEPARATION OF BLUE MAOMAO AND SWEEP. *N.Z. J. Mar. Freshwater Res.* 13(4):549-551. 1979. SFA 25(2)
[Fish Res. Div., Minist. Agric. Fish., P.O. Box 19062, Wellington, New Zealand] Fourteen proteins and 12 morphometric characters were examined in specimens of blue maomao and sweep to resolve the question: Are they one or two species? Specimens were fixed for the same alleles at 12 protein loci and shared alleles at 4 polymorphic loci. At a further polymorphic locus they differed in allele frequency and at three loci they did not share alleles. A

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80-001467 CONTINUED genetic distance of 0.209 was found between blue maomao and sweep suggesting that they diverged about 1 million years ago. One meristic character showed a difference between specimens. On the basis of the electrophoretic data and on gill raker counts it is considered that blue maomao and sweep are two separate species. In view of reported differences from Australian specimens the allocation of scientific names at least to sweep remains uncertain.

80-001468 Van Guelpen, L. TAXONOMIC VARIABILITY AND CRITERIA FOR DISTINGUISHING METAMORPHOSING LARVAL AND JUVENILE STAGES OF *LIMANDA FERRUGINEA* AND *HIPPOGLOSSOIDES PLATESSOIDES* (PISCES: PLEURONECTIDAE) FROM THE SCOTIAN SHELF. *Can. J. Zool.* 58(2):202-206. Feb. 1980. In English with English summ. SFA 25(2)

[Huntsman Mar. Lab., St. Andrews, NB E0G 2X0, Canada] Metamorphosing larval and juvenile *Limanda ferruginea* and *Hippoglossoides platessoides* from the Scotian Shelf were examined to characterize their taxonomic variability and to establish the reliability of criteria for their identification. The species were found to be separable using several characters. *Limanda ferruginea* had 11 to 12 precaudal and 41 to 44 total vertebrae, 38 to 41 total myomeres, 51 to 67 anal fin rays, and usually metamorphosed at less than 16 mm standard length (SL). *Hippoglossoides platessoides* had 13 to 14 precaudal and 45 to 48 total vertebrae, 44 to 47 total myomeres, 62 to 76 anal fin rays, and usually metamorphosed at greater than 25 mm SL. Anal fin ray counts and size at metamorphosis were of limited diagnostic value only. In addition, stage IV *L. ferruginea* usually had dark gut pigment and a visible modified first anal pterygiophore (anal spine), whereas *H. platessoides* had light gut pigment and no visible anal spine. Dark gut pigment also was diagnostic for juvenile *L. ferruginea* still prossessing this character.

80-001469 Wilimovsky, N. J. and D. E. Wilson. A NEW SPECIES OF AGONIDAE, *AGONOMALUS MOZINOI*, FROM THE WEST COAST OF NORTH AMERICA. *Syesis* 11:73-79. 1978. SFA 25(2)

[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

80-001470 Zidek, J. *ACANTHODES LUNDI*, NEW SPECIES (ACANTHODII), AND ASSOCIATED COPROLITES FROM UPPERMOST MISSISSIPPIAN HEATH FORMATION OF CENTRAL MONTANA. *Ann. Carnegie Mus. Nat. Hist.* 49(3):49-78. 4 Mar. 1980. SFA 25(2)

[Univ. Okla., Norman 73019]

PARASITES AND DISEASES-GENERAL

80-001471 Armas, G. OBSERVATIONS ON DISEASES AND PARASITES OF MULLET ALEVINS *MUGIL CEPHALUS* L. FROM THE RÍO MOCHE COASTAL LAGOON OF PERU. *J. Fish Dis.* 2(6):543-547. Nov. 1979. SFA 25(2)

[Prog. Biol. Pesq., Univ. Nac. Trujillo, Apt. Correos No. 6231 Trujillo, Peru]

80-001472 Arthur, J. R. and H. P. Arai. STUDIES ON THE PARASITES OF PACIFIC HERRING (*CLUPEA HARENGUS PALLASI* VALENCIENNES): SURVEY RESULTS. *Can. J. Zool.* 58(1):64-70. Jan. 1980. In English with French summ.

PARASITES AND DISEASES-GENERAL

80-001472 CONTINUED SFA 25(2)
[Fish. Mar. Serv., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

80-001473 Glenn, C. L. SEASONAL PARASITIC INFECTIONS IN MOONEYE, *HIODON TERGISUS* (LESUEUR), FROM THE ASSINIBOINE RIVER. *Can. J. Zool.* 58(2):252-257. Feb. 1980. In English with French summ. SFA 25(2)
[Dep. Zool., Brandon Univ., Brandon, MB R7A 6A9, Canada]

80-001474 Ingram, G. A. SUBSTANCES INVOLVED IN THE NATURAL RESISTANCE OF FISH TO INFECTION--A REVIEW. *J. Fish Biol.* 16(1):23-60. Jan. 1980. SFA 25(2)
[Dep. Biol., Gardner St. Annexe, Univ. Salford, Salford M6 6WZ, Lancashire, England] Natural 'antibodies' are substances found in the blood of animals that have not been immunised against infective agents. However, exposure to these agents or to cross-reacting antigens may well have taken place. Fish contain naturally-occurring, relatively non-specific, lectin-like proteins or glycoproteins, which are distinct from immunoglobulins, and which react with a wide variety of antigens and may confer some degree of immunity against natural infection. In most cases the cause of the antigenic stimulus is not obvious although the formation of these 'antibodies' may have been brought about by exposure to various micro-organisms. Many of these antibody-like molecules behave in a similar manner to immune antibodies or immunoglobulins and cross-react with specific carbohydrate moieties on the cell walls of bacteria, erythrocytes and certain other cellular antigens, due to the presence of similar antigenic determinants. It is difficult to ascribe an appropriate definition to the term 'natural antibody'. In fish, these 'antibodies' have been so designated on the basis of functional rather than structural criteria. Such naturally-occurring, low grade, antibody-like 'immune' substances include 'acute phase' proteins, lysozyme and chitinase, interferon, agglutinins, lysins, complement and properdin, precipitins, and non-immunoglobulin, lectin-like molecules. In addition to the above non-immunoglobulin materials, natural immunoglobulins identifiable as IgM have also been reported in fish. Furthermore, mucus contains many biochemical agents capable of reaction against infective organisms and thus providing the host with an immediate or a first line of defence mechanism. This review compiles some of the relevant information in the literature concerned with natural 'immune' sbustances, present in the serum and mucus of fish, involved in protection against pathogens. Wherever possible the basic physicochemical properties of these substances are indicated and their potential immunobiological functions are discussed.

80-001475 Katae, H.; K. Kouno; Y. Takase; H. Miyazaki; M. Hashimoto and M. Shimizu. THE EVALUATION OF PIROMIDIC ACID AS AN ANTIBIOTIC IN FISH: AN *IN VITRO* AND *IN VIVO* STUDY. *J. Fish Dis.* 2(4):321-335. July 1979. SFA 25(2)

80-001476 McCain, B. B.; W. D. Gronlund; M. S. Myers and S. R. Wellings. TUMOURS AND MICROBIAL DISEASES OF MARINE FISHES IN ALASKAN WATERS. *J. Fish Dis.* 2(2):111-130. Mar. 1979. SFA 25(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-001477 Olson, L. J. HOST-PARASITE ASSOCIATIONS OF THE GRUNIONS, *LEURESTHES SARDINA* AND *LEURESTHES TENUIS*, FROM THE GULF OF CALIFORNIA AND CALIFORNIA. *Ph.D. dissertation, Univ. Ariz.* 111p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4164. Mar. 1980. SFA 25(2)

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80-001478 Rijkers, G. T.; A. G. Teunissen; R. Van Oosterom; and W. B. Van Muiswinkel. THE IMMUNE SYSTEM OF CYPRINID FISH. THE IMMUNOSUPPRESSIVE EFFECT OF THE ANTIBIOTIC OXYTETRACYCLINE IN CARP (*CYPRINUS CARPIO* L.). *Aquaculture* 19(2):177-189. Feb. 1980. SFA 25(2)
[Dep. Exp. Anim. Morphol. Cell Biol., Agric. Univ., Zodiac, Marijkeweg 40, 6709 PG Wageningen, The Netherlands]

80-001479 Spannhof, L., D. Nasev and H.-L. Kreutzmann. EARLY RECOGNITION OF METABOLIC DISTURBANCES IN TROUT (*SALMO GAIRDNERI* RICH.) STOCKS. *Aquaculture* 18(4):317-323. Dec. 1979. SFA 25(2)
[Dep. Biol. Wilhelm Pieck Univ. Rostock, Universitätsplatz 2, 25 Rostock, West Germany] A method is proposed for detecting metabolic disturbances or diseases in trout stocks before typical symptoms appear. The method involves determination of erythrocyte numbers, hemoglobin contents, and hematocrit readings for about 10 animals. The measured parameters are tested for independence. The results permit the stocks tested to be classified as "normal" or "not normal".

80-001480 Watson, R. A. and T. A. Dick. METAZOAN PARASITES OF WHITEFISH *COREGONUS CLUPEAFORMIS* (MITCHILL) AND CISCO *C. ARTEDII* LESUEUR FROM SOUTHERN INDIAN LAKE, MANITOBA. *J. Fish Biol.* 15(5):579-587. Nov. 1979. SFA 25(2)
[Dep. Zool., Univ. Manitoba, Winnipeg, MB R3T 2N2, Canada]

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80-001481 Håstein, T.; S. J. Saltveit and R. J. Roberts. MASS MORTALITY AMONG MINNOWS *PHOXINUS PHOXINUS* (L.) IN LAKE TVEITEVATN, NORWAY, DUE TO AN ABERRANT STRAIN OF *AEROMONAS SALMONICIDA*. *J. Fish Dis.* 1(3):241-249. July 1978. SFA 25(2)
[Nat. Vet. Inst., P.O. Box 8156, Oslo, Norway]

80-001482 Anderson, D. P.; B. S. Robertson and O. W. Dixon. CELLULAR IMMUNE RESPONSE IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON TO *YERSINIA RUCKERI* O-ANTIGEN MONITORED BY THE PASSIVE HAEMOLYTIC PLAQUE ASSAY TEST. *J. Fish. Dis.* 2(3):169-178. May 1979. SFA 25(2)
[U.S. FWS, Rt. 3, Box 50, Kearneysville, WV 25430] The specificity and kinetics of the immune response of rainbow trout (*Salmo gairdneri*) to single injections of an O-antigen extracted from the bacterial pathogen *Yersinia ruckeri*, which causes enteric redmouth in fish, were investigated by the passive haemolytic plaque assay and serum antibody quantitation. Doses ranging from 5 ng to 500 mg in 10-fold increments were injected intraperitoneally into groups of trout held at 17±1.5°C. The occurrence of plaque forming cells (PFC) and humoral antibody was followed for 35 days after injection. Trout gave an immune response to doses of 500 ng and above. Seven days after injection no humoral antibody was detected, but PFC were found in the spleen. The maximum PFC numbers occurred 11 days after injection. On day 21, few PFC were found, whereas serum antibody titres were highest. The antibody from immunized trout showed little or no cross-reactions with sheep red blood cells passively labelled with antigens from other fish pathogens.

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80-001483 Bach, R.; P. K. Chen and G. B. Chapman. CHANGES IN THE SPLEEN OF THE CHANNEL CATFISH *ICTALURUS PUNCTATUS* RAFINESQUE INDUCED BY INFECTION WITH *AEROMONAS HYDROPHILA*. *J. Fish Dis.* 1(3):205-217. July 1978. SFA 25(2)
[P. K. Chen: Dep. Biol., Georgetown Univ., Washington, DC 20057]

80-001484 Barham, W. T.; G. L. Smit and H. J. Schoonbee. THE EFFECT OF BACTERIAL INFECTION ON ERYTHROCYTE FRAGILITY AND SEDIMENTATION RATE OF RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON. *J. Fish Biol.* 16(2):177-180. Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Zululand, Private Bag, Kwa-Dlangezwa 3886, South Africa] Osmotic fragilities and erythrocyte sedimentation rates (ESR) were measured in healthy, diseased, treated and recovered trout, *Salmo garidneri*. Bacterial infection with *Aeromonas* and *Streptococcus* resulted in more fragile erythrocytes and raised ESR values. Treatment with antibacterial agents improved the values of both parameters. Possible reasons for such changes are discussed. Caution in the use of apparently healthy fish for the unqualified interpretation of haematological results is expressed.

80-001485 Bejerano, Y.; S. Sarig; M. T. Horne and R. J. Roberts. MASS MORTALITIES IN SILVER CARP *HYPOPHTHALMICHTHYS MOLITRIX* (VALENCIENNES) ASSOCIATED WITH BACTERIAL INFECTION FOLLOWING HANDLING. *J. Fish Dis.* 2(1):49-56. Jan. 1979. SFA 25(2)
[R. J. Roberts: Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] Mass mortalities in silver carp were related to infection of handling lesions with *Proteus rettgeri*, a gram negative bacterium normally found in the gut of poultry. Poultry faeces are used extensively to fertilize carp ponds and experimental infections showed that the condition could be reproduced by scarification and exposure to the micro-organism or by its inoculation.

80-001486 Bullock, G. L.; B. R. Griffin and H. M. Stuckey. DETECTION OF *CORYNEBACTERIUM SALMONINUS* BY DIRECT FLUORESCENT ANTIBODY TEST. *Can. J. Fish. Aquatic Sci.* 37(4):719-721. Apr. 1980. SFA 25(2)
[U.S. FWS, Natl. Fish Health Res. Lab., Rt. 3, Box 50, Kearneysville, WV 25430]

80-001487 Bullock, G. L.; H. M. Stuckey and E. B. Shotts, Jr. ENTERIC REDMOUTH BACTERIUM: COMPARISON OF ISOLATES FROM DIFFERENT GEOGRAPHIC AREAS. *J. Fish Dis.* 1(4):351-356. Oct. 1978. SFA 25(2)
[U.S. FWS, Natl. Fish Health Res. Lab., Kearneysville, WV 25430] Characteristics of 18 strains of *Yersinia ruckeri* the causative agent of enteric redmouth disease, from a variety of hosts and a wide geographic range were compared. Except for variations in colonial morphology and in citrate, sorbitol, and trehalose reactions, the strains were morphologically and biochemically homogeneous. Sixteen strains reacted with antiserum against the first serotype reported, and one strain reacted with antiserum against a more recently reported serotype. One strain represented a third serotype. Evidence presented indicated that extension of the geographic range may not be entirely a result of the transport of carrier fish.

80-001488 Egidius, E. and K. Andersen. THE USE OF FURANACE AGAINST VIBRIOSIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON IN SALT WATER. *J. Fish Dis.* 2(1):79-80. Jan. 1979. SFA 25(2)
[Inst. Mar. Res., Dir. Fish., 5011 Bergen-Nordnes, Norway]

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80-001489 Egidius, E. C. and K. Andersen. BATH-IMMUNIZATION--A PRACTICAL AND NON-STRESSING METHOD OF VACCINATING SEA FARMED RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON AGAINST VIBRIOSIS. *J. Fish Dis.* 2(5):405-410. Sept. 1979. SFA 25(2)

[Inst. Mar. Res., Boks 1870-72, 5011 Bergen-Nordnes, Norway] A non-stressing easily applicable vaccination method against vibriosis in rainbow trout is described. The vaccine consisted of trypsin digested *Vibrio anguillarum* cells and was administered through a 2 h bath treatment, giving adequate protection in challenge experiments with the same *V. anguillarum* strain.

80-001490 Ferguson, H. W. and D. H. McCarthy. HISTOPATHOLOGY OF FURUNCULOSIS IN BROWN TROUT *SALMO TRUTTA* L. *J. Fish. Dis.* 1(2):165-174. Apr. 1978. SFA 25(2)

[Vet. Res. Lab., The Farm, Stormont, Belfast, Northern Ireland]

80-001491 Flagg, R. M. and L. W. Hinck. INFLUENCE OF AMMONIA ON AEROMONAD SUSCEPTIBILITY IN CHANNEL CATFISH. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:415-419. 1978[1979]. SFA 25(2)

[Biol. Sci., Ark. State Univ., State University 72467] The effects of unionized ammonia on channel catfish (*Ictalurus punctatus*) resistance to aeromonad invasion were tested. Host susceptibility to *Aeromonas hydrophila* was related to ammonia concentration and time of exposure. Numbers of bacteria recovered from host livers increased as concentrations of unionized ammonia were increased in the range of 0.02-0.04 mg/l NH_3. The effect of longer exposure time at these concentrations also proved to be significant ($P<0.01$) in lowering host resistance.

80-001492 Giavenni, R. ALCUNI ASPETTI ZOONOSICI DELLE MICOBATTERIOSI DI ORIGINE ITTICA. [HUMAN SKIN LESIONS BY FISH MYCOBACTERIA.] *Riv. It. Piscic. Ittiop.* 14(4):123-126. Oct.-Nov.-Dec. 1979. In Italian with English summ. SFA 25(2)

[Med. Vet., S.I.R.A.P. S.p.A., 30100 Pellestrina, Venezia, Italy]

80-001493 Harbell, S. C.; H. O. Hodgins and M. H. Schiewe. STUDIES ON THE PATHOGENESIS OF VIBIOSIS IN COHO SALMON *ONCORHYNCHUS KISUTCH* (WALBAUM). *J. Fish Dis.* 2(5):391-404. Sept. 1979. SFA 25(2)

[M. H. Schiewe: NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112] Juvenile coho salmon *Oncorhynchus kisutch* (Walbaum), cultured in fresh water, were experimentally infected with highly virulent *Vibrio anguillarum*, and various haematological and biochemical parameters were compared between moribund and non-infected control fish. In addition, endotoxin, culture supernatant, and cell lysate preparations of *V. anguillarum* were tested separately and in combination to assess their roles in mediating pathological effects. The haematocrit, haemoglobin, numbers of red and white blood cells and plasma, total protein, albumin, β_2 globulin, chloride, sodium, osmolality and alkaline phosphatase levels were all decreased in infected fish compared to controls. Erythrocyte fragility and plasma glucose, potassium, lactate dehydrogenase (LDH), and glutamic oxaloacetic transaminase (GOT) levels were increased in infected fish. No mortality nor significant changes in haematocrit or plasma protein occurred in fish infected intraperitoneally with 35 mg/kg (1 mouse LD_{50}) of *V. anguillarum* endotoxin, with culture supernatant fluid, cell lysate, or with combinations of three preparations. There was, however, a decrease in plasma protein concentration in coho injected with 355 mg/kg (10 mouse LD_{50}s) of endotoxin, but no mortality nor significant change in haematocrit.

BACTERIAL DISEASES

80-001494 Huizinga, H. W.; G. W. Esch and T. C. Hazen. HISTOPATHOLOGY OF RED-SORE DISEASE (*AEROMONAS HYDROPHILA*) IN NATURALLY AND EXPERIMENTALLY INFECTED LARGEMOUTH BASS *MICROPTERUS SALMOIDES* (LACÉPÈDE). *J. Fish. Dis.* 2(4):263-277. July 1979. SFA 25(2)

[G. W. Esch: Dep. Biol., Wake Forest Univ., Winston-Salem, NC 27109] The histopathology of red-sore disease, caused by the gram-negative bacterium, *Aeromonas hydrophila*, is described for largemouth bass, *Micropterus salmoides*. Externally, lesions range from those affecting a few scales (pin-point), to those associated with extensive chronic ulcerations; there is focal haemorrhage, oedema and dermal necrosis which exposes underlying muscles producing infiltration of mononuclear and granulocytic inflammatory cells. Internally, the liver and kidneys are foci for toxic products produced by *A. hydrophila* with, in the most severe cases, complete destruction of the structural integrity of both organs. Pathological changes were not serious in either the spleen or heart, even in cases with massive damage in the liver and kidney. Internal and external lesions were similar in both natural and experimentally induced infections. The pathobiology of red-sore disease in bass is postulated to be linked to elevated water temperature stimulating increased metabolism, decreased body condition and stress, leading to the increased production of corticosteroids and the concomitant rise in susceptibility to infection.

80-001495 Inebi, W. and M. T. Horne. A COMPLEMENT-FIXATION METHOD FOR THE DETECTION OF *VIBRIO*-SPECIFIC ANTIBODIES IN RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON. *J. Fish Dis.* 2(2):159-160. Mar. 1979. SFA 25(2)

[Dep. Biol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001496 Ingram, G. A. and J. B. Alexander. THE IMMUNE RESPONSE OF THE BROWN TROUT *SALMO TRUTTA* TO LIPOPOLYSACCHARIDE. *J. Fish Biol.* 16(2):181-197. Feb. 1980. SFA 25(2)

[Dep. Biol., Gardner St. Annexe, Univ. Salford, Salford M6 6WZ, England] Brown trout produced high molecular weight, thermostable, dithiothreitol sensitive, non-precipitating, complement-fixing antibodies and agglutinins to lipopolysaccharides after intramuscular injection with adjuvant. Antibodies were first detected on Day 14 and reached maximum titres after 56 to 63 days when a single injection was given. When either a second or third injection was administered maximum titres occurred 34 to 40 days after the injection. After each injection the titres increased significantly, and the protein concentration of the sera was significantly decreased. In cellulose acetate electrophoresis experiments those bands which migrated in the β- to γ-globulin regions were increased. Antibody-secreting and antigen-binding cells were detected on Days 8 and 4 respectively and maxima were reached between Day 16 and Day 18. The number of cells per 10^6 lymphoid cells was higher in the spleen than in the kidney.

80-001497 Katae, H.; K. Kouno; Y. Sekine; M. Hashimoto and M. Shimizu. DISTRIBUTION, EXCRETION AND BIOTRANSFORMATION OF ^{14}C-PIROMIDIC ACID IN GOLDFISH *CARASSIUS AURATUS* (L.). *J. Fish Dis.* 2(6):529-542. Nov. 1979. SFA 25(2)

[M. Shimizu: Res. Lab., Dainippon Pharmaceutical Co., Ltd., 33-94 Enoki-cho, Suita, Osaka, 564, Japan]

80-001498 Kimura, H. and R. Kusuda. STUDIES ON THE PATHOGENESIS OF STREPTOCOCCAL INFECTION IN CULTURED YELLOWTAILS *SERIOLA* SPP.: EFFECT OF THE CELL FREE CULTURE ON EXPERIMENTAL STREPTOCOCCAL INFECTION. *J. Fish Dis.* 2(6):501-510. Nov. 1979. SFA 25(2)

[R. Kusuda: Fish Dis. Lab., Dep. Cult. Fish, Fac. Agric. Kochi Univ., Nankoku, Kochi Pref., Japan]

BACTERIAL DISEASES

80-001499 Laidler, L. A. DETECTION AND IDENTIFICATION OF THE BACTERIAL KIDNEY DISEASE (BKD) ORGANISM BY THE INDIRECT FLUORESCENT ANTIBODY TECHNIQUE. *J. Fish Dis.* 3(1):67-69. Jan. 1980. SFA 25(2)
[M.A.F.F. Vet. Invest. Cent., Calthwaite, Penrith, Cumbria, England]

80-001500 Llewellyn, L. C. A BACTERIUM WITH SIMILARITIES TO THE REDMOUTH BACTERIUM AND *SERRATIA LIQUEFACIENS* (GRIMES AND HENNERTY) CAUSING MORTALITIES IN HATCHERY REARED SALMONIDS IN AUSTRALIA. *J. Fish Dis.* 3(1):29-39. Jan. 1980. SFA 25(2)
[N.S.W. State Fish., Sydney, New South Wales, Australia] Blood spots in the eye and haemorrhages in the musculature of the caudal peduncle were the main indication of disease in Australian hatchery reared brook trout *Salvelinus fontinalis* (Mitchill) and Atlantic salmon *Salmo salar* L. Mortalities of 0.1-0.5% per day occurred for 3-4 weeks in fish stocked in circular ponds in the months of February and March when temperatures were falling from 23-11°C. The bacterium belonging to the Family Enterobacteriacae had similarities with *Yersinia ruckeri* (the RM bacterium) and *Serratia liquefaciens*. As a temporary designation SBS was used. It is recommended that its taxonomic position remain *sub judice* for the present. Inoculation experiments on brook trout and landlocked Atlantic salmon indicated that signs appeared 2-7 days after inoculation and that rainbow trout *Salmo gairdneri* Richardson were resistant to the disease.

80-001501 Lounatmaa, K. and J. Janatuinen. ELECTRON MICROSCOPY OF AN ULCERATIVE DERMAL NECROSIS (UDN)-LIKE SALMON DISEASE IN FINLAND. *J. Fish Dis.* 1(4):369-375. Oct. 1978. SFA 25(2)
[Dep. Electron Microsc., Univ. Helsinki, Malminkatu 20, SF-00100 Helsinki 10, Finland]

80-001502 Michel, C. A STANDARDIZED MODEL OF EXPERIMENTAL FURUNCULOSIS IN RAINBOW TROUT (*SALMO GAIRDNERI*). *Can. J. Fish. Aquatic Sci.* 37(4):746-750. Apr. 1980. SFA 25(2)
[Inst. Natl. Rech. Agron., Lab. Ichtyopathol., route de Thiverval, 78850 Thiverval-Grignon, France]

80-001503 Nishibuchi, M.; K. Muroga; R. J. Seidler and J. L. Fryer. PATHOGENIC *VIBRIO* ISOLATED FROM CULTURED EELS--IV. DEOXYRIBONUCLEIC ACID STUDIES. *Bull. Jpn. Soc. Sci. Fish.* 45(12):1469-1473. Dec. 1979. SFA 25(2)
[Fac. Appl. Biol. Sci., Hiroshima Univ., 2-17 Midori-Machi, Fukuyama 720, Japan]

80-001504 Reynolds, W. W.; J. B. Covert and M. E. Casterlin. FEBRILE RESPONSES OF GOLDFISH *CARASSIUS AURATUS* (L.) TO *AEROMONAS HYDROPHILA* AND TO *ESCHERICHIA COLI* ENDOTOXIN. *J. Fish Dis.* 1(3):271-273. SFA 25(2)
[Dep. Biol., Pa. State Univ., Wilkes-Barre 18708]

80-001505 Roberts, R. J. and M. T. Horne. BACTERIAL MENINGITIS IN FARMED RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON AFFECTED WITH CHRONIC PANCREATIC NECROSIS. *J. Fish Dis.* 1(2):157-164. Apr. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Scotland] Chronic mortalities associated with meningeal and pancreatic lesions are described, from two trout farms in Scotland. Histopathological and microbiological studies

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80-001505 CONTINUED suggested that bacterial infection with strains of *Pseudomonas fluorescens* of low pathogenicity was developing in fish already affected by the lesions of chronic infectious pancreatic necrosis virus infection (IPN). Antibiotic therapy reduced losses temporarily; eradiation of the virus resulted in complete elimination of the condition.

FUNGAL DISEASES

80-001506 Agius, C. INFECTION BY AN *ICHTHYOPHONUS*-LIKE FUNGUS IN THE DEEP-SEA SCABBARD FISH *APHANOPUS CARBO* (LOWE) (TRICHIURIDAE) IN THE NORTH EAST ATLANTIC. *J. Fish Dis.* 1(2):191-193. Apr. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001507 Blazer, V. S. and R. E. Wolke. AN *EXOPHIALA*-LIKE FUNGUS AS THE CAUSE OF A SYSTEMIC MYCOSIS OF MARINE FISH. *J. Fish Dis.* 2(2):145-152. Mar. 1979. SFA 25(2)
[R. E. Wolke: Mar. Pathol. Lab., Dep. Anim. Pathol., Univ. R.I., Kingston 02881]

80-001508 Emerson, M.; B. L. Nicholson and R. Bayer. EFFECTS OF *ACHOLEPLASMA LAIDLAWII* AND AN UNIDENTIFIED MYCOPLASMA ON SELECTED FISH CELL CULTURES AND THE REPLICATION OF FISH VIRUSES. *J. Fish. Dis.* 2(3):227-238. May 1979. SFA 25(2)
[B. L. Nicholson: Dep. Microbiol., Univ. Me., Orono 04473] An unidentified mycoplasma was isolated from cultures of Atlantic salmon (AS) cells and implicated as the cause of cytopathic effects (CPE). The agent did not visibly affect RTG-2 cells. Experimental infection of RTG-2 cells with *Acholeplasma laidlawii* resulted in increased cellular granularity and destruction. Scanning electron microscopic (SEM) examination of infected RTG-2 and AS cultures revealed typical mycoplasmas distributed on cell surfaces and a marked effect on the cell surface topography, characterized by a loss of microvilli and cellular processes. SEM also revealed mycoplasmal contamination that was not detected by culturing. Comparisons of contaminated and uncontaminated RTG-2 cells showed enhanced (2-100 fold) replication of infectious pancreatic necrosis virus (IPNV) and infectious haematopoietic necrosis virus (IHNV) in the presence of *A. laidlawii*.

80-001509 Richards, R. H.; A. Holliman and S. Helgason. *EXOPHIALA SALMONIS* INFECTION IN ATLANTIC SALMON *SALMO SALAR* L. *J. Fish Dis.* 1(4):357-368. Oct. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001510 Richards, R. H. and A. D. Pickering. CHANGES IN SERUM PARAMETERS OF *SAPROLEGNIA*-INFECTED BROWN TROUT, *SALMO TRUTTA* L. *J. Fish Dis.* 2(3):197-206. May 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling, FK9 4LA, Scotland] Fungal infection of both wild and hatchery-reared sexually mature brown trout, *Salmo trutta* L., was caused by *Saprolegnia diclina* Humphrey Type 1. The major ions in the serum of infected fish were all significantly reduced in concentration and it is suggested that the primary cause of death was osmoregulatory breakdown resulting in a lethal haemodilution. Severe

FUNGAL DISEASES

80-001510 CONTINUED hypoproteinaemia and a significant reduction in the albumin/globulin ratio were reflected in the electrophoretogram of the serum proteins from infected fish.

PROTOZOAN DISEASES

80-001511 Molnár, K. RENAL SPHAEROSPOROSIS IN THE COMMON CARP *CYPRINUS CARPIO* L. *J. Fish Dis.* 3(1):11-19. Jan. 1980. SFA 25(2)
[Vet. Med. Res. Inst., Hungarian Acad. Sci., Budapest, Hungary] *Sphaerospora angulata* fujita, 1912, has been identified as a frequent renal parasite of cultured carp populations in Hungary. Its prevalence ranged from 10 to 50% in the pond farms surveyed. The youngest carp infected were 2 1/2-3 months old. Infections were not common in one-summer fish and tended to become less frequent with increasing age of the host. The developing stages of *S. angulata* are found in the contorted tubules of the trunk-kidney but never invade the parenchymal tissue of the trunk or head-kidneys. The pansporoblasts developing in the wide proximal segment of the renal tubules, and the spores arising from the pansporoblasts are typically coelozoic parasites, for they apparently do not damage the tubular lining epithelium, nor its brush border. The main adverse effect of *S. angulata* is probably depression of resistance owing partly to deprivation of the host of nutrients secreted by the glomeruli and partly to mechanical obstruction of the distal tubular segments.

80-001512 Andrews, C. THE OCCURRENCE OF *HENNEGUYA PSOROSPERMICA* THÉLOHAN, 1895 (MYXOSPORIDA) ON PERCH, *PERCA FLUVIATILIS* L., FROM LLYN TEGID, WALES. *J. Fish Dis.* 2(1):27-33. Jan. 1979. SFA 25(2)
[Yorkshire Water Authority, Olympia House, Gelderd Rd., Leeds LS12 6DD, England]

80-001513 Becker, C. D. and R. M. Overstreet. HAEMATOZOA OF MARINE FISHES FROM THE NORTHERN GULF OF MEXICO. *J. Fish Dis.* 2(6):469-479. Nov. 1979. SFA 25(2)
[Battelle Mem. Inst., Pac. Northwest Lab., Richland, WA 99352]

80-001514 Becker, C. D. HAEMATOZOA FROM RESIDENT AND ANADROMOUS FISHES OF THE CENTRAL COLUMBIA RIVER: A SURVEY. *Can. J. Zool.* 58(3):356-362. Mar. 1980. In English with French summ. SFA 25(2)
[Ecol. Sci. Dep., Pac. Northwest Lab., Richland, WA 99352]

80-001515 Berrebi, P. ETUDE ULTRASTRUCTURAL DE *GLUGEA ATHERINAE* N. SP., MICROSPORIDIE PARASITE DE L'ATHÉRINE *ATHERINA BOYERI* RISSO 1810 (POISSON TÉLÉOSTÉEN) DANS LES LAGUNES DU LANGUEDOC ET DE PROVENCE. [ULTRASTRUCTURAL STUDIES OF *GLUGEA ATHERINAE* N. SP., MICROSPORIDIA PARASITE OF *ATHERINA BOYERI* RISSO 1810 (PISCES, TELEOSTAEN) IN THE LANGUEDOC AND PROVENCE LAGOONS.] *Z. Parasitenkd.* 60(2):105-122. 1979. In French with English summ. SFA 25(2)
[Lab. Ichthyol., Univ. Sci. Tech. Lang., Place Eugene Bataillon, 34060 Montpellier Cedex, France]

PROTOZOAN DISEASES

80-001516 Cheung, P. J.; R. F. Nigrelli and G. D. Ruggieri. STUDIES ON CRYPTOCARYONIASIS IN MARINE FISH: EFFECT OF TEMPERATURE AND SALINITY ON THE REPRODUCTIVE CYCLE OF *CRYPTOCARYON IRRITANS* BROWN, 1951. *J. Fish Dis.* 2(2):93-97. Mar. 1979. SFA 25(2)

[Osborn Lab. Mar. Sci., N.Y. Aquarium, N.Y. Zool. Soc., Brooklyn, NY 11224] Trophonts of *Cryptocaryon irritans* Brown from infected three-spot damselfish, *Dascyllus trimaculatus* Ruppell, were kept at temperatures ranging from 7 to 37°C to observe encystment and development of the tomites. At 30, 25 and 20°C, the percentage of trophonts that had encysted in 16 h were 70, 77 and 64% respectively; at 37°, 44% encysted and at 7°C only 10% had encysted. The optimum temperature for encystment was 30°C; 50% excysted in 5 days and 100% in 7 days. At 25°C, 60% of the tomites started to excyst on the eighth day, and 70% on the ninth day. At 20°C, 10% started to excyst on the ninth day, reaching 40% on the tenth day. No excystment occurred at 37 and 7°C. Newly encysted tomonts were placed in various dilutions of sea water (31°/oo) and kept at temperatures ranging from 7 to 37°C. Low salinities, i.e. 16°/oo and lower caused tomonts to rupture. At 37, 20 and 7°C, 35% of the tomonts started to rupture immediately in 50% sea water, while at 30 and 25°C, 30% of the tomonts ruptured in 25% seawater. However, none of the cysts developed normally at these dilutions. The percentage rupturing increased with decreasing salinity.

80-001517 Current, W. L.; J. Janovy, Jr. and S.A. Knight. *MYXOSOMA FUNDULI* KUDO (MYXOSPORIDA) IN *FUNDULUS KANSAE*: ULTRASTRUCTURE OF THE PLASMODIUM WALL AND OF SPOROGENESIS. *J. Protozool.* 26(4):574-583. Nov. 1979. SFA 25(2)

[Dep. Zool.-Entomol., Auburn Univ., Auburn, AL 36830]

80-001518 de Kinkelin, P. OCCURRENCE OF A MICROSPORIDIAN INFECTION IN ZEBRA DANIO *BRACHYDANIO RERIO* (HAMILTON-BUCHANAN). *J. Fish Dis.* 3(1):71-73. Jan. 1980. SFA 25(2)

[Lab. Ichtyopathol., Inst. Natl. Rech. Agron. 78850 Thiverval-Grignon, France]

80-001519 Dyková, I. and J. Lom. HISTOPATHOLOGICAL CHANGES IN *TRYPANOSOMA DANILEWSKYI* LAVERAN & MESNIL, 1904 AND *TRYPANOPLASMA BORELLI* LAVERAN & MESNIL, 1902 INFECTIONS OF GOLDFISH, *CARASSIUS AURATUS* (L.). *J. Fish Dis.* 2(5):381-390. Sept. 1979. SFA 25(2)

[Inst. Parasitol., Czech. Acad. Sci., Flemingovo nám-2, 166 32 Prague 6, Czechoslovakia]

80-001520 Ellis, A. E. and R. Wootten. COSTIASIS OF ATLANTIC SALMON, *SALMO SALAR* L. SMOLTS IN SEAWATER. *J. Fish Dis.* 1(4):389-393. Oct. 1978. SFA 25(2)

[Mar. Lab., Victoria Rd., Aberdeen AB9 8DB, Scotland]

80-001521 Ferguson, H. W. SCANNING AND TRANSMISSION ELECTRON MICROSCOPICAL OBSERVATIONS ON *HEXAMITA SALMONIS* (MOORE, 1922) RELATED TO MORTALITIES IN RAINBOW TROUT FRY *SALMO GAIRDNERI* RICHARDSON. *J. Fish Dis.* 2(1):57-67. Jan. 1979. SFA 25(2)

[Vet. Res. Lab., Stormont, Belfast BT4 3SD, Northern Ireland] Examination of the digestive tract of rainbow trout fry infected with *Hexamita salmonis* revealed no pathological changes in the epithelial cells of the pyloric caeca or upper intestine even where the parasites were closely apposed to the brush border of these cells. No invasion of the epithelium by

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80-001521 CONTINUED the parasites was observed, although examples of shrinkage necrosis (apoptotic bodies) of epithelial cells were often found. The ultrastructure of the parasites resembled that of the closely related *Giardia lamblia*. Despite the lack of pathological changes to the intestinal epithelium, treatment of the fish to remove the parasites greatly reduced mortalities.

80-001522 Hoffman, G. L. and R. Walker. A NEW MYXOSPORIDAN, *DICAUDA ATHERINOIDI* N.G., N. SP., OF THE MINNOW, *NOTROPIS ATHERINOIDES* RAFINESQUE. *J. Fish Dis.* 1(4):343-349. Oct. 1978. SFA 25(2)
[U.S. FWS, P.O. Box 860, Stuttgart, AR 72160]

80-001523 Hoffman, G. L.; S. L. Kazubski; A. J. Mitchell and C. E. Smith. *CHILODONELLA HEXASTICHA* (KIERNIK, 1909) (PROTOZOA, CILIATA) FROM NORTH AMERICAN WARMWATER FISH. *J. Fish Dis.* 2(2):153-157. Mar. 1979. SFA 25(2)
[U.S. FWS, P.O. Box 860, Stuttgart, AR 72160]

80-001524 Kirmse, P. D. *HAEMOGREGARINA SACHAI* N.SP. FROM CULTURED TURBOT *SCOPHTHALMUS MAXIMUS* (L.) IN SCOTLAND. *J. Fish Dis.* 1(4):337-342. Oct. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001525 Molnar, K. and M. Reinhardt. INTESTINAL LESIONS IN GRASSCARP *CTENOPHARYNGODON IDELLA* (VALENCIENNES) INFECTED WITH *BALANTIDIUM CTENOPHARYNGODONIS* CHEN. *J. Fish. Dis.*1(2):151-156. Apr. 1978. SFA 25(2)
[Vet. Med. Res. Inst., Hungarian Acad. Sci., Budapest, Hungary] The protozoan *Balantidium ctenopharyngodonis* is a common intestinal commensal of two-summer and older grasscarp, but it may occasionally become pathogenic under the influence of certain predisposing factors. Outbreaks of enteritis complicated by excess multiplication of balantidia occurred among the two-summer and three-summer grasscarp stock in two pond farms during the autumn and winter. Fishes in the terminal stage of disease showed hyperaemia and inflammation of the mucosa over the entire gut. In the posterior 10-12 cm of the gut a dense creamy exudate coated the mucosa. Large numbers of balantidia were found in the exudate and between the mucosal folds there were excoriations, the size of a pin-head, obviously caused by the parasites. Histological examination revealed a loss of superficial epithelium and ulcerations in the grooves between folds.

80-001526 Rau, M. E. and D. M. Gordon. THE FREQUENCY DISTRIBUTION OF TETRACOTYLES OF *APATEMON GRACILIS PELLUCIDUS* (YAMAGUTI, 1933) IN STICKLEBACK *CULAEA INCONSTANS* (KIRTLAND) POPULATIONS OF HOMOGENEOUS AGE AND SIZE STRUCTURE. *J. Fish Dis.* 1(3):259-263. July 1978. SFA 25(2)
[Inst. Parasitol., McGill Univ., Macdonald Coll. P.O., PQ H0A 1C0, Canada] The frequency distribution of tetracotyles of *Apatemon gracilis pellucidus* in natural populations of brook sticklebacks *Culaea inconstans* homogeneous for age and size were fitted to negative binomial curves. Vales of *k* were unusually high while the degree of overdispersion was correspondingly low. It is suggested that these properties of the distributions are a function of the homogeneity of the host population.

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80-001527 Robertson, D. A. HOST-PARASITE INTERACTIONS BETWEEN *ICHTYOBODO NECATOR* (HENNEGUY, 1883) AND FARMED SALMONIDS. *J. Fish Dis.* 2(6):481-491. Nov. 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] The prevalence and intensity of *Ichtyobodo necator* infestations on farmed salmonids was investigated over a 7-month period. The infestations were found to be markedly age dependent. *Ichtyobodo* infestations peaked at 4 weeks after commencement of first feeding and mortalities peaked at 4.6% per week at 8 weeks in the 0+ fish. Both infestations and mortalities showed a marked decline to zero shortly after these periods with no chemotherapy. No *Ichtyobodo* were seen on the 1+ fish until late in the study after a drop in temperature to below 10°C, when they reappeared in the 0+ fish also. *Ichtyobodo* were found at temperatures between 3.5°C and 16°C and in the 0+ fish appeared irrespective of the condition of the fish. It is suggested that some form of host defence mechanism is operating which limits *Ichtyobodo* infestations in farmed salmonids.

80-001528 Wyatt, E. J. STUDIES ON THE EPIZOOTIOLOGY OF *MYXOBOLUS INSIDIOSUS* WYATT AND PRATT, 1963 (PROTOZOA: MYXOSPORIDA). *J. Fish Dis.* 1(3):233-240. July 1978. SFA 25(2)
[Dep. Biol., Hamline Univ., St. Paul, MN 55104] *Myxobolus insidiosus* from the striated musculature of chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), was studied in disease free and naturally contaminated waters. Infection could not be induced in susceptible fish in a disease free water supply by any means tried. Experiments in naturally contaminated waters provided data on minimum and other exposure times. Studies were also carried out on the effect of water temperature, different substrates and flow rates, time of the year and size of fish on infection. The rainbow trout, *Salmo gairdneri* Richardson, was also checked for infection and not found with this disease in naturally contaminated waters. Transovarian infection was ruled out.

80-001529 Yamamoto, T. and J. E. Sanders. LIGHT AND ELECTRON MICROSCOPIC OBSERVATIONS OF SPOROGENESIS IN THE MYXOSPORIDA, *CERATOMYXA SHASTA* (NOBLE, 1950). *J. Fish Dis.* 2(5):411-428. Sept. 1979. SFA 25(2)
[Dep. Microbiol., Univ. Alberta, Edmonton, AB T6G 2E9, Canada]

VIRAL DISEASES

80-001530 Ahne, W. UPTAKE AND MULTIPLICATION OF SPRING VIRAEMIA OF CARP VIRUS IN CARP, *CYPRINUS CARPIO* L. *J. Fish Dis.* 1(3):265-268. July 1978. SFA 25(2)
[Inst. Zool. Hydrobiol., Univ. Munich, Kaulbachstr. 37, 8 Munich 22, West Germany]

80-001531 Amin, O. M. LYMPHOCYSTIS DISEASE IN WISCONSIN FISHES. *J. Fish Dis.* 2(3):207-217. May 1979. SFA 25(2)
[Sci. Div., Univ. Wis., Kenosha 53141]

80-001532 Amlacher, E.; J. Ude; C. Rudolph and G. Ernst. DIRECT ELECTRON MICROSCOPICAL VISUALIZATION OF THE PRESUMPTIVE VIRUS OF VIRAL HAEMORRHAGIC SEPTICAEMIA (VHS) IN THE RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON AND ADDITIONAL HISTOPATHOLOGICAL AND HAEMATOLOGICAL OBSERVATIONS. *J. Fish Dis.* 3(1):55-62. Jan. 1980. SFA 25(2)
[Inst. Pathol. Friedrich-Schiller, Univ. Jena, DDR-69 Jena,

VIRAL DISEASES

80-001532 CONTINUED Ziegelmühlenweg 1, West Germany] Electron microscopical and histopathological investigations were carried out on the anterior kidney of ten 1-year-old farmed rainbow trout naturally infected with the external signs of viral haemorrhagic septicaemia (VHS). The histopathology of the liver and the haematology of peripheral blood were also examined. The presumptive virus of VHS was directly demonstrated for the first time in the anterior kidney. All diseased fishes showed necrotic changes in the kidney and the liver. The melano-macrophage centres of the anterior kidney showed a partial destruction accompanied with a loss of melanin. A progressive destruction of the erythrocytes was observed. The liver exhibited moderate to extensive necrosis (karyorrhexis and karyolysis with lymphocytic invasion in the necrotic areas). Neither intranuclear nor intracytoplasmatic inclusions were observed. In the peripheral blood diverse stages of erythrocytic degeneration, amitoses of the erythrocytes and a five-fold increase in lymphocyte numbers were observed.

80-001533 Buchanan, J. S. and C. R. Madeley. STUDIES ON *HERPESVIRUS SCOPHTHALMI* INFECTION OF TURBOT *SCOPHTHALMUS MAXIMUS* (L.) ULTRASTRUCTURAL OBSERVATIONS. *J. Fish Dis.* 1(4):283-295. Oct. 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001534 Bucke, D.; J. Finlay; D. McGregor and C. Seagrave. INFECTIOUS PANCREATIC NECROSIS (IPN) VIRUS: ITS OCCURRENCE IN CAPTIVE AND WILD FISH IN ENGLAND AND WALES. *J. Fish Dis.* 2(6):549-553. Nov. 1979. SFA 25(2)
[Fish Dis. Lab., The Nothe, Weymouth, Dorset, England]

80-001535 Carlisle, J. C.; K. A. Schat and R. Elston. INFECTIOUS HAEMATOPOIETIC NECROSIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON IN A SEMI-CLOSED SYSTEM. *J. Fish Dis.* 2(6):511-517. Nov. 1979. SFA 25(2)
[Dep. Avian Aquatic Med., N.Y. State Coll. Vet. Med., Cornell Univ., Ithaca 14853]

80-001536 Castric, J. and P. de Kinkelin. OCCURRENCE OF VIRAL HAEMORRHAGIC SEPTICAEMIA IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON REARED IN SEA-WATER. *J. Fish Dis.* 3(1):21-27. Jan. 1980. SFA 25(2)
[P. de Kinkelin: Lab. Ichtyopathol. Inst. Natl. Rech. Agon., 78850 Thiverval-Grignon, France] Viral haemorrhagic septicaemia (VHS) is reported for the first time in sea-water cultured rainbow trout. Heavy mortalities with typical signs and lesions occurred about 1 month after the trout were transferred from fresh to sea-water. A VHS virus (serotype 1) was isolated from the diseased fish. The mortalities were caused only by the VHS virus and 80 days post transfer of trout to sea-water the mortalities reached 85% of the initial population. The disease was experimentally transmitted to rainbow trout, both in sea-water and freshwater, either by immersing the fish in contaminated water containing $3 \cdot 10^4$ pfu/ml of virus or by intramuscular injection of various doses of VHS_1 ($7 \cdot 10^1$, $7 \cdot 10^4$ or $7 \cdot 10^6$ pfu per fish). Death occurred in all infected groups and started earlier in sea-water. Typical signs of VHS were observed in moribund fish. Viral multiplication was demonstrated to have occurred in fish organs.

VIRAL DISEASES

80-001537 Cleator, G. M. and L. A. Burney. THE HAEMAGGLUTINATING PROPERTIES OF INFECTIOUS PANCREATIC NECROSIS VIRUS. *Arch. Virol.* 63(2):81-85. 1980. SFA 25(2)
[Dep. Bacteriol. Virol., Univ. Manchester, Manchester, England]

80-001538 Dorson, M. and C. Torchy. COMPLEMENT DEPENDENT NEUTRALIZATION OF EGTVED VIRUS BY TROUT ANTIBODIES. *J. Fish Dis.* 2(4):345-347. July 1979. SFA 25(2)
[Lab. Ichtyo-pathol., INRA, Route Thiverval, 78850 Thiverval-Grignon, France]

80-001539 Dorson, M.; J. Castric and C. Torchy. INFECTIOUS PANCREATIC NECROSIS VIRUS OF SALMONIDS: BIOLOGICAL AND ANTIGENIC FEATURES OF A PATHOGENIC STRAIN AND OF A NON-PATHOGENIC VARIANT SELECTED IN RTG-2 CELLS. *J. Fish. Dis.* 1(4):309-320. Oct. 1978. SFA 25(2)
[Lab. Ichtyopathol., INRA, Route Thiverval, 78850, Thiverval, Grignon, France] A non-pathogenic cell culture adapted variant was obtained from a normally pathogenic strain of IPN virus (Sp type) after several passages in RTG-2 cells. This cell culture modified (CCA) strain was compared with the original wild (W) strain in various tests. Cross neutralization tests showed no obvious antigenic difference between the two. However the CCA strain was neutralized by a 1:5000 dilution of normal trout serum whereas the W strain was not. In RTG-2 cells, CCA strain gave both large and small plaques, whereas the W strain gave only small ones. Both virus strains were heat sensitive and labile to cyclic freezing and thawing. The CCA virus was more stable in storage at 4°C under different pH conditions and its growth in RTG-2 cells was more rapid. The rt (supra-optimal temperature at which viral yield is depressed by 90%) appeared to be 19-20°C for the CCA strain and 18-19°C for the W strain. Pre-treatment of RTG-2 cells with ultraviolet inactivated CCA virus, could inhibit growth of W virus, but had no effect on replication of homologous virus.

80-001540 Fijan, N. N. and G. Giorgetti. INFECTIOUS PANCREATIC NECROSIS: ISOLATION OF VIRUS FROM EYED EGGS OF RAINBOW TROUT *SALMO GAIRDNERI* RICHARSON. *J. Fish Dis.* 1(3):269-270. July 1978. SFA 25(2)
[Dep. Biol. Pathol. Fish Bees, Univ. Zagreb, 41001 Zagreb, POB 190, Yugoslavia]

80-001541 Hedrick, R. P.; J. C. Leong and J. L. Fryer. PERSISTENT INFECTIONS IN SALMONID FISH CELLS WITH INFECTIOUS PANCREATIC NECROSIS VIRUS (IPNV). *J. Fish Dis.* 1(4):297-308. Oct. 1978. SFA 25(2)
[J. L. Fryer: Dep. Microbiol., Nash Hall, Oreg. State Univ., Corvallis 97331] Two cell lines that are persistently infected with IPN virus have been established. Viral persistence in the cultures was demonstrated by the detection of infectious virus (10^2-$10^{5.5}$ $TCID_{50}$/ml) in the culture fluids, by specific immunoflourescence, and by their resistance to superinfection by homologous virus. The growth rate of these cells was indistinguishable from normal, uninfected cells. Virus stocks harvested from persistently infected cultures contained a greater proportion of defective, interfering particles than those from lytically infected cells which suggests that these particles may be responsible for the maintenance of these carrier cultures.

VIRAL DISEASES

80-001542 Hetrick, F. M.; J. L. Fryer and M. D. Knittel. EFFECT OF WATER TEMPERATURE ON THE INFECTION OF RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON WITH INFECTIOUS HAEMATOPOIETIC NECROSIS VIRUS. *J. Fish. Dis.* 2(3):253-257. May 1979. SFA 25(2)
[Dep. Microbiol., Univ. Md., College Park 20742]

80-001543 Nicholson, B. L.; G. W. Thorne, C. Janicki and A. Hanson. STUDIES ON A HOST RANGE VARIANT FROM DIFFERENT ISOLATES OF INFECTIOUS PANCREATIC NECROSIS VIRUS (IPNV). *J. Fish Dis.* 2(5):367-379. Sept. 1979. SFA 25(2)
[Dep. Microbiol., Univ. Me., Orono 04473] Eight isolates of infectious pancreatic necrosis virus (IPNV) propagated solely in RTG-2 cells (RTG-IPNV) were examined for ability to replicate in FHM cells. Seven isolates replicated in FHM cells; however, the plaque titres were 10- to greater than 100,000-fold less than titres in RTG-2 cells. The ability of IPNV to replicate in FHM cells was shown to result from the presence of a host range variant (FHM-IPNV) that produced plaques in both cell types. Variant-free preparations of two isolates differed in ability to generate FHM-IPNV during a single replication cycle in RTG-2 cells. One isolate did not generate the variant and failed to replicate in FHM cells even upon blind passage. IPNV propagated in AS cells (AS-IPNV) was similar to RTG-IPNV, producing equal numbers of plaques in RTG-2 and AS cells but failing to form plaques in FHM cells. However, IPNV propagated in BF-2 cells (BF-IPNV) was similiar to FHM-IPNV in producing equal numbers of plaques in all three cell lines. RTG-IPNV and FHM-IPNV were identical in size, morphology and density in CsCl but differed in plaque size distribution and neutralization by specific antiserum. Restriction of the replication of RTG-IPNV in FHM cells was partially explained by a reduction of 75% in adsorption to FHM cells. However, the synthesis of RTG-IPNV antigens was reduced 90 to > 99% in FHM cells.

80-001544 Plumb, J. A. and J. Chappell. SUSCEPTIBILITY OF BLUE CATFISH TO CHANNEL CATFISH VIRUS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:680-685. 1978[1979]. SFA 25(2)
[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830] The susceptibility of blue catfish, (*Ictalurus furcatus*), and reciprocal channel (*I. punctatus*) x blue catfish hybrids to channel catfish virus (CCV) was determined through several methods of exposure. Mortalities of blue catfish, when injected intraperitoneally with CCV, were similar to what would be expected with channel catfish. Histopathology of CCV-injected blue catfish did not deviate from that of similarly infected channel catfish. Infection of blue catfish and the hybrids by swabbing the gills, dipping fish in a virus solution, or by cohabitation with CCV-diseased fish were primarily ineffective. It is concluded that blue catfish and hybrids of channel catfish x blue catfish are as equally susceptible as channel catfish to injection of CCV but the blue catfish are refractive to the virus by more natural routes of transmission.

80-001545 Richards, R. H. and J. S. Buchanan. STUDIES ON *HERPESVIRUS SCOPHTHALMI* INFECTION OF TURBOT *SCOPHTHALMUS MAXIMUS* (L.): HISTOPATHOLOGICAL OBSERVATIONS. *J. Fish Dis.* 1(3):251-258. July 1978. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] The histological features of the disease caused by infection of turbot by *Herpesvirus scophthalmi* are described. Infection of epidermal cells of skin and gill resulted in the formation of giant cells showing a variety of nuclear and cytoplasmic changes associated with the replication of the virus. The effects of the condition together with possible control measures are discussed.

VIRAL DISEASES

80-001546 Smail, D. A. and S. I. Egglestone. VIRUS INFECTIONS OF MARINE FISH ERYTHROCYTES: ELECTRON MICROSCOPICAL STUDIES ON THE BLENNY VIRUS. *J. Fish Dis.* 3(1):47-54. Jan. 1980. SFA 25(2)
[DAFS Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland] This paper reports for the first time the application of the direct negative staining technique for the rapid confirmation of the viral nature of blenny 'piscine erythrocytic necrosis' (PEN). The virus in negatively stained preparations has an internal core structure which appears in exact opposite contrast to that seen in thin sectioned virus. The resultant images from both negative staining and thin sectioning suggest that the organization of the core is unique amongst intracytoplasmic deoxyriboviruses (ICDVs).

80-001547 Smail, D. A. and S. I. Egglestone. VIRUS INFECTIONS OF MARINE FISH ERYTHROCYTES: PREVALENCE OF PISCINE ERYTHROCYTIC NECROSIS IN COD *GADUS MORHUA* L. AND BLENNY *BLENNIUS PHOLIS* L. IN COASTAL AND OFFSHORE WATERS OF THE UNITED KINGDOM. *J. Fish Dis.* 3(1):41-46. Jan. 1980. SFA 25(2)
[DAFS Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland] Giemsa stained blood smears prepared from blennies caught on the shores of southern England and from cod taken from the Celtic and North seas revealed fish with clinical 'piscine erythrocytic necrosis' (PEN). The findings recorded here extend the distribution data on PEN infections and report that the infection in the blenny and cod may possibly have a similar developmental pattern. Data are presented on the prevalence of the infection in the fish population samples and on the proportion of infected cells in the smears examined.

80-001548 Wolf, K. E.; M. C. Quimby; C. P. Carlson and W. J. Owens. LYMPHOCYSTIS VIRUS: INFECTIVITY OF LESION PREPARATIONS STORED AFTER LYOPHILIZATION OR SIMPLE DESICCATION. *J. Fish Dis.* 2(3):259-260. May 1979. SFA 25(2)
[U.S. FWS, Rt. 3, Box 50, Kearneysville, WV 25430]

OTHER DISEASES AND PARASITES

80-001549 Amin, O. M. EFFECT OF HOST SPAWNING ON *ECHINORHYNCHUS SALMONIS* MÜLLER, 1784 (ACANTHOCEPHALA: ECHINORHYNCHIDAE) MATURATION AND LOCALIZATION. *J. Fish. Dis.* 1(2):195-197. Apr. 1978. SFA 25(2)
[Sci. Div., Univ. Wis., Kenosha 53141]

80-001550 Bailey, W. C.; J. Ginal and L. G. Mitchell. VICERAL FIBROSIS IN BLUEGILLS IN CENTRAL IOWA. *Proc. Iowa Acad. Sci.* 87(1):24. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Iowa State Univ., Ames 50011] Unusually severe liver and visceral fibroses were observed in a population of bluegills (*Lepomis macrochirus*) from the Iowa State University Horticulture farm pond in Story County during 1977-79. The lesions were associated with heavy infections of metacercariae of the trematode, *Posthodiplostomum minimum*, and plerocercoids of *Proteocephalus ambloplitis*. Affected bluegills were from 3 to 7 years of age. Parasite loads were heavy, averaging 1700 metacercariae and 5 plerocercoids per host. Fibrotic lesions varying from scattered tubular branched foci in livers to massive adhesions throughout the viscera occurred in 60 (14.6%) of 411 bluegills examined during 1978-79. Lesions in 83% of these fish were melanotic. In section, severely affected livers consisted of islets of hepatocytes interspersed with rigid fibrotic cysts. Cysts were formed of concentric layers of dense fibers, often containing melanin granules and remnants of melanin macrophages. Central cores of cysts appeared empty or were partially filled by amorphous debris or metacercariae. Despite

OTHER DISEASES AND PARASITES

80-001550 CONTINUED the apparent severity of this condition and the heavy parasite loads, affected bluegills showed no obvious external signs of disease.

80-001551 Blasiola, G. C., Jr. and J. C. Turnier. ALGAL INFECTION OF THE SEVENGILL SHARK, *NOTORYNCHUS MACULATUS* AYRES. *J. Fish Dis.* 2(2):161-163. Mar. 1979. SFA 25(2)
[Steinhart Aquarium, Golden Gate Park, San Francisco, CA 94118]

80-001552 Bray, R. A. and D. I. Gibson. THE FELLODISTOMIDAE (DIGENEA) OF FISHES FROM THE NORTHEAST ATLANTIC. *Bull. Br. Mus. (Nat. Hist.) Zool.* 37(4):199-293. 28 Feb. 1980. SFA 25(2)
[Dep. Zool., Brit. Bull. (Nat. Hist.), Cromwell Rd., London SW7 5BD, England]

80-001553 Bucke, D.; G. D. Cawley; J. F. Craig; A. D. Pickering and L. G. Willoughby. FURTHER STUDIES OF AN EPIZOOTIC OF PERCH *PERCA FLUVIATILIS* L., OF UNCERTAIN AETIOLOGY. *J. Fish. Dis.* 2(4):297-311. July 1979. SFA 25(2)
[A. D. Pickering: Freshwater Biol. Assoc., The Ferry House, Far Sawrey, Ambleside, Cumbria LA22 0LP, England] The geographical distribution of an epizootic of perch *Perca fluviatilis* L., characterized by severe epidermal lesions and marked fish kills, is described. A wide variety of fungal and bacterial infections were found in diseased fish but the evidence suggests that they were not the primary cause of this condition. The primary pathogenic agent (assuming that it exists) or predisposing environmental factor has yet to be discovered. The severity of this disease is illustrated by monitoring the course of the epizootic in the perch population in Windermere. All age groups of fish were affected during the course of one year although the fish at spawning time appeared to be particularly vulnerable. There was a dramatic increase in the perch mortality in Windermere in 1976 and it is estimated that over 98% of the adult population (over 1 million fish) died in that year.

80-001554 Bullock, A. M. and R. J. Roberts. INDUCTION OF UDN-LIKE LESIONS IN SALMONID FISH BY EXPOSURE TO ULTRAVIOLET LIGHT IN THE PRESENCE OF PHOTOTOXIC AGENTS. *J. Fish Dis.* 2(5):439-441. Sept. 1979. SFA 25(2)
[Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyl, PA34 4AD, Scotland]

80-001555 Bullock, A. M.; R. S. Batty and D. A. Neave. LIPOPHOROMATOSIS IN ADULT PLAICE *PLEURONECTES PLATESSA* L. *J. Fish Dis.* 2(6):567-568. Nov. 1979. SFA 25(2)
[Dunstaffnage Mar. Res. Lab., Oban, Argyllshire, Scotland]

80-001556 Carvajal, J.; P. E. Cattan; C. Castillo and P. Schatte. LARVAL ANISAKIDS AND OTHER HELMINTHS IN THE HAKE, *MERLUCCIUS GAYI* (GUICHENOT) FROM CHILE. *J. Fish Biol.* 15(6):671-677. Dec. 1979. SFA 25(2)
[Lab. Zool., Inst. Cienc. Biol., Univ. Católica de Chile, Casilla 114-D, Santiago, Chile]

OTHER DISEASES AND PARASITES

80-001557 Cattan, P. E.; J. Carvajal; D. Torres and J. L. Yáñez. PRIMERA COMUNICACIÓN SOBRE CESTODOS TRYPANORHYNCHA EN PECES DEL ARCHIPIÉLAGO DE JUAN FERNÁNDEZ. [FIRST REPORT ON TRYPANORHYNCHA CESTODES IN FISH FROM JUAN FERNÁNDEZ ARCHIPELAGO]. *Bol. Chil. Parasitol.* 34(1/2):44-46. 1979. In Spanish with English summ. SFA 25(2)
[Dep. Cienc. Pecuar. Bas., Fac. Med. Vet., Univ. Chile, Santiago, Chile]

80-001558 Conroy, D. A. and J. A. Santacana. A CASE OF GOITRE AND ITS TREATMENT IN A GOLDFISH *CARASSIUS AURATUS* (L.). *J. Fish Dis.* 2(6):555-556. Nov. 1979. SFA 25(2)
[Fac. Cienc. Vet., Univ. Cent. Venezuela, Apt. Correos No. 4563, Maracay, Edo. Aragua, Venezuela]

80-001559 Crowden, A. E. and D. M. Broom. EFFECTS OF THE EYEFLUKE, *DIPLOSTOMUM SPATHACEUM*, ON THE BEHAVIOUR OF DACE *(LEUCISCUS LEUCISCUS). Anim. Behav. (Baillière Tindall, Publ.)* 28(1):287-294. Feb. 1980. SFA 25(2)
[Dep. Zool., Univ. Reading, Reading RG6 2AJ, England]

80-001560 Dojiri, M. and P. S. Perkins. A NEW GENUS OF CYCLOPOID COPEPOD (CHONDRACANTHIDAE) PARASITIC ON HALIBUT FROM CALIFORNIA INSHORE WATERS. *J. Parasitol.* 65(5):794-803. Oct. 1979. SFA 25(2)
[Boston Univ. Mar. Prog., Mar. Biol. Lab., Woods Hole, MA 02543]

80-001561 Edwards, C. J. ALGAL INFECTIONS OF FISH TISSUE: A RECENT RECORD AND REVIEW. *J. Fish. Dis.* 1(2):175-179. Apr. 1978. SFA 25(2)
[Ohio Coop. Fish. Res. Unit, 1735 Neil Ave., Columbus 43210]

80-001562 Fahy, E. *EUBOTHRIUM CRASSUM* IN MIGRATORY TROUT, *SALMO TRUTTA* L., IN THE SEA. *J. Fish Biol.* 16(1):99-104. Jan. 1980. SFA 25(2)
[Rosminna, Drumree, Co. Meath, Ireland] The incidence and intensity of infection of various ages and conditions of migratory trout by *Eubothrium crassum* are described. A marine source of the worm seems likely and explanations for the characteristics of the parasite burden are given on this assumption. Within weeks of first going to sea the hosts accumulate large numbers of the parasites. One year suffices for the life cycle of *Eubothrium* but growth continues for at least two years and possibly for longer. The parasite burden decreases in older fish because of the stress imposed on the parasite by successive migrations of the host to and from fresh water and because older fish tend to feed earlier in the year.

80-001563 Ferguson, H. W. and H. J. Ball. EPIDEMIOLOGICAL ASPECTS OF PROLIFERATIVE KIDNEY DISEASE AMONGST RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON IN NORTHERN IRELAND. *J. Fish Dis.* 2(3):219-225. May 1979. SFA 25(2)
[Dep. Agric., Vet. Res. Lab., Stormont, Belfast BT4 3SD, Northern Ireland] The epidemiology of PKD is described as it relates to one affected farm in Northern Ireland. From 1972-1976 stocking and management practices led to mortality of 10-15% amongst the 0+ fish. 1+ or older fish were never affected. In 1977 and 1978, however, delaying the stocking of the farm until July eliminated deaths in the 0+ fish, and mortality in these 1977-moved fish the subsequent year remained at an absolute minimum. Preliminary observations suggest that a means of controlling the disease has been found. Experimental work demonstrates that the resistance of 1+ or older fish is due to previous exposure and is not an age-related immunity. Experimental work also suggests the presence of an incubation period of 6-7 weeks and that the peak time of

OTHER DISEASES AND PARASITES

80-001563 CONTINUED infectivity is probably around May. None of the evidence detracts from the possibility that an infectious agent is involved although an attempt to transmit the disease failed.

80-001564 Fischthal, J. H. *ASYMPHYLODORA FISHELSONI* SP. N. (TREMATODA: MONORCHIIDAE) FROM A CYPRINODONTID FISH, *APHANIUS DISPAR RICHARDSONI* (BOULENGER), FROM ISRAEL, AND ITS ALLOMETRIC GROWTH. *J. Helminthol.* 53(4):357-362. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., State Univ. N.Y., Binghampton 13901]

80-001565 Gibson, D. I. and R. A. Bray. *CIRKENNEDYA PORLOCKENSIS*, A NEW GENUS AND SPECIES OF DIGENEAN FROM THE SUNFISH *MOLA MOLA* (L.). *J. Helminthol.* 53(3):245-250. Sept. 1979. SFA 25(2)
[Zool. Dep., Brit. Mus. (Nat. Hist.), Cromwell Rd., London SW7 5BD, England]

80-001566 Goil, M. M. and R. P. Harpur. A COMPARISON OF THE NON-SPECIFIC ACID PHOSPHOMONOESTERASE ACTIVITY IN THE LARVA OF *PHOCANEMA DECIPIENS* (NEMATODA) WITH THAT OF THE MUSCLE OF ITS HOST THE CODFISH (*GADUS MORHUA*). *Z. Parasitenkd.* 60(2):177-183. 1979. SFA 25(2)
[R. P. Harpur: Inst. Parasitol., McGill Univ., Macdonald Coll., Ste-Anne-de-Bellevue, PQ H9X 1C0, Canada]

80-001567 Haller, R. D. and R. J. Roberts. DUAL NEOPLASIA IN A SPECIMEN OF *SAROTHERODON SPILURUS SPILURUS* (GÜNTHER) (= *TILAPIA SPILURUS*). *J. Fish Dis.* 3(1):63-66. Jan. 1980. SFA 25(2)
[R. J. Roberts: Unit Aquatic Pathobiol., Inst. Aquacult., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001568 Hard, G. C.; R. Williams and J. Lee. HISTOPATHOLOGY OF SUPERFICIAL FISH 'TUMOURS' FOUND DURING A CANCER SURVEY OF DEMERSAL SPECIES IN PORT PHILIP BAY, VICTORIA, AUSTRALIA. *J. Fish Dis.* 2(6):455-467. Nov. 1979. SFA 25(2)
[Fels Res. Inst., Temple Univ., Sch. Med., 3420 N. Broad St., Philadelphia, PA 19140]

80-001569 Harrison, J. G. and R. H. Richards. THE PATHOLOGY AND HISTOPATHOLOGY OF NEPHROCALCINOSIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARSON IN FRESH WATER. *J. Fish Dis.* 2(1):1-12. Jan. 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] A detailed histopathological study of naturally occurring and experimentally induced outbreaks of nephrocalcinosis was carried out on rainbow trout from a number of farms. Histopathological effects were confined to the kidney, stomach and skeletal muscle. Lesions of the stomach wall were often found in the absence of renal lesions but muscle lesions were only found in the presence of severe renal damage. It was considered that the calcification was the result of deposition of calcium salts within necrotic tissue, and thus was dystrophic rather than metastatic. Variation between farms was considered to be due to variations in the effects of different aetiological factors in the complex series of physico-chemical events which appear to induce the condition.

OTHER DISEASES AND PARASITES

80-001570 Hayunga, E. G. OBSERVATIONS ON THE INTESTINAL PATHOLOGY CAUSED BY THREE CARYOPHYLLID TAPEWORMS OF THE WHITE SUCKER *CATOSTOMUS COMMERSONI* Lacépedè. *J. Fish Dis.* 2(3):239-248. May 1979. SFA 25(2)
[Immunoparasitol. Dep., Naval Med. Res. Inst., Bethesda, MD 20014]

80-001571 Henderson-Arzapalo, A.; R. R. Stickney and D. H. Lewis. IMMUNE HYPERSENSITIVITY IN INTENSIVELY CULTURED *TILAPIA* SPECIES. *Trans. Am. Fish. Soc.* 109(2):244-247. Mar. 1980. SFA 25(2)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Stn. 77843]

80-001572 Heufelder, G. R. and P. J. Schneeberger. OCCURRENCE OF THE ACANTHOCEPHALAN *LEPTORHYNCOIDES THECATUS* IN SLIMY SCULPINS--A NEW HOST RECORD. *Trans. Am. Fish. Soc.* 109(1):142-144. Jan. 1980. SFA 25(2)
[Great Lakes Res. Div., Univ. Mich. Inst. Sci. Technol., Ann Arbor 48109]

80-001573 Hoffman, G. L. ASIAN TAPEWORM, *BOTHRIOCEPHALUS ACHEILOGNATHI* YAMAGUTI, 1934, IN NORTH AMERICA. *Fisch. Umwelt* 8:69-75. 1980. SFA 25(2)
[U.S. FWS, Fish Farm. Exp. Stn., Stuttgart, AR]

80-001574 Iwama, G. K. "ONE-EYE", A DISEASE OF RAINBOW TROUT (*SALMO GAIRDNERI*) AT THE KOOTENAY TROUT HATCHERY, BRITISH COLUMBIA. *British Columbia Minist. Recreation Conserv. Fish. Manage. Rep.* No. 42. 11p. 1979. SFA 25(2)

80-001575 Kruse, G. O. W. TREMATODES OF MARINE FISHES FROM SOUTH AUSTRALIA. 4. *HARVEYTREMA BISULCATUM* GEN. ET SP. N. (LEPOCREADIIDAE). *J. Parasitol.* 65(6):918-920. Dec. 1979. SFA 25(2)
[Univ. Nebr. State Mus., Lincoln 68588]

80-001576 Kruse, G. O. W. TREMATODES OF MARINE FISHES FROM SOUTH AUSTRALIA. 6. *MONOSTEPHANOSTOMUM MANTERI* GEN. ET SP. N. (ACANTHOCOLPIDAE). *J. Parasitol.* 65(6):921-923. Dec. 1979. SFA 25(2)
[Univ. Nebr. State Mus., Lincoln 68588]

80-001577 Lester, R. J. G. DESCRIPTIONS OF TWO NEW DIDYMOZOIDS FROM AUSTRALIAN FISHES. *J. Parasitol.* 65(6):904-908. Dec. 1979. SFA 25(2)
[Dep. Parasitol., Univ. Queensland, St. Lucia, Brisbane, Australia 4067]

80-001578 Llewellyn, J.; S. MacDonald and J. E. Green. HOST-SPECIFICITY AND SPECIATION IN DICLIDOPHORAN (MONOGENEAN) GILL PARASITES OF TRISOPTERAN (GADOID) FISHES AT PLYMOUTH. *J. Mar. Biol. Assoc. UK* 60(1):73-79. Feb. 1980. SFA 25(2)
[Dep. Zool. Comp. Physiol., Univ. Birmingham, P.O. Box 363, Birmingham, England] *Trisopterus minutus minutus* has been free of monogenean parasites for at least 25 years but in 1979 about 5% of Plymouth specimens have become parasitized by *Diclidophora esmarkii*. *D. esmarkii* was formerly thought to be indistinguishable morphologically from *d. luscae* which is a common parasite of *Trisopterus luscus* at Plymouth but a renewed comparison of *D. luscae* and *D. esmarkii* has revealed a diagnostic difference in the size of the attachment clamps, in the charasteristic number of eggs in the egg bundles, and in the relative development of the intra-pharyngeal glands. In 1979 there has been an influx into Plymouth water, presumably from more western and northern regions, of *Trisopterus esmarki*, bringing with it *D. esmarkii* and it is suggested that this parasite is less strictly species-specific than *D. luscae* and, given the opportunity, has now parasitized Plymouth *T. m. minutus*. It has not, however, colonized *T. luscus*.

OTHER DISEASES AND PARASITES

80-001579 MacDonald, S. and J. Llewellyn. REPRODUCTION IN *ACANTHOCOTYLE GREENI* N. SP. (MONOGENEA) FROM THE SKIN OF *RAJA* SPP. AT PLYMOUTH. *J. Mar. Biol. Assoc. UK* 60(1):81-88. Feb. 1980. SFA 25(2)
[Dep. Zool. Comp. Physiol., Univ. Birmingham, P.O. Box 363, Birmingham, England]

80-001580 Mahajan, C. L.; N. K. Agrawal; M. J. John and V. P. Katta. EFFECT OF THE DIGENEAN *ISOPARORCHIS HYPSELOBAGRI* (BILLET, 1898) ON AN AIRBREATHING FISH *CHANNA PUNCTATUS* (BLOCH) WITH PARTICULAR REFERENCE TO BIOCHEMICAL AND HAEMATOLOGICAL CHANGES. *J. Fish Dis.* 2(6):519-528. Nov. 1979. SFA 25(2)
[Dep. Zool., Univ. Rajasthan, Jaipur-302004, India]

80-001581 McArthur, C. P. HUMORAL ANTIBODY PRODUCTION BY NEW ZEALAND EELS, AGAINST THE INTESTINAL TREMATODE *TELOGASTER OPISTHORCHIS* MACFARLANE, 1945. *J. Fish Dis.* 1(4):377-387. Oct. 1978. SFA 25(2)
[Pathol. Dep., Coll. Med., Univ. Fla., Gainesville 32610]

80-001582 McVicar, A. H. and P. G. White. FIN AND SKIN NECROSIS OF CULTIVATED DOVER SOLE *SOLEA SOLEA* (L.). *J. Fish Dis.* 2(6):557-562. Nov. 1979. SFA 25(2)
[DAFS Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland]

80-001583 Mills, C. A. ATTACHMENT AND FEEDING OF THE ADULT ECTOPARASITIC DIGENEAN *TRANSVERSOTREMA PATIALENSE* (SOPARKAR, 1924) ON THE ZEBRA FISH *BRACHYDANIO RERIO* (HAMILTON-BUCHANAN). *J. Fish Dis.* 2(5):443-447. Sept. 1979. SFA 25(2)
[Freshwater Biol. Assoc., River Lab., East Stoke, Wareham, Dorset BH20 6BB, England]

80-001584 Muroga, K.; T. Yoshimatsu and S. Kasahara. *UROCLEIDUS FEROX* (MONOGENEA: DACTYLOGYRIDAE) FROM BLUEGILL SUNFISH IN JAPAN. *Bull. Jpn. Soc. Sci. Fish.* 46(1):27-30. Jan. 1980. SFA 25(2)
[Fac. Appl. Biol. Sci., Hiroshima Univ., Fukuyama 720, Japan]

80-001585 Nammalwar, P. A NOTE ON HYPEROSTOSIS IN THE PERCH *POMADASYS HASTA* (BLOCH). *Indian J. Fish.* 23(1/2):247-249. 1976. SFA 25(2)
[Bombay Res. Cent. C.M.F.R. Inst., Bombay 400001, India] A case of hyperostosis in the skull bones of the perch, *Pomadasys hasta*, is reported. The oval-shaped protuberance of frontal and supraoccipital bones of the skull and also a small depression between the eyes are very prominent. This gives to the skull a hump-like appearance.

80-001586 Paperna, I.; I. Sabnai and M. Castel. ULTRASTRUCTURAL STUDY OF EPITHELIOCYSTIS ORGANISMS FROM GILL EPITHELIUM OF THE FISH *SPARUS AURATA* (L.) AND *LIZA RAMADA* (RISSO) AND THEIR RELATION TO THE HOST CELL. *J. Fish Dis.* 1(2):181-189. Apr. 1978. SFA 25(2)
[H. Steinitz Mar. Lab., Elat, Israel]

OTHER DISEASES AND PARASITES

80-001587 Peters, G. and N. Peters. THE INFLUENCE OF SALINITY ON GROWTH AND STRUCUTRE OF EPIDERMAL PAPILLOMAS OF THE EUROPEAN EEL *ANGUILLA ANGUILLA* L. *J. Fish. Dis.* 2(1):13-26. Jan. 1979. SFA 25(2)

[Inst. Hydrobiol. Fischereiwiss. Univ., Olbersweg 24, 2 Hamburg 50, West Germany] Papillomatosis of the European eel *Anguilla anguilla* L. occurs predominantly in waters of low to medium salinity (3-20°/oo). Tumour-bearing eels were kept under laboratory conditions for several weeks in salt concentrations of 8, 15 and 30 °/oo. As opposed to those kept in freshwater, the experimental animals showed significant decreases in tumour growth rate. At the same time the tumour tissue underwent a marked redifferentiation, i.e. the originally poorly differentiated neoplastic tissue developed numerous mucous and club cells. The characteristic intercellular spaces of tumorous tissue disappeared with the formation of regular membrane interdigitations between adjacent cells. The nucleus to cytoplasm ratios of the neoplastic cells decreased to one-third of those of the untreated tumour. These changes resulted in a reversion of the neoplastic tissue to a structural condition essentially similar to that of normal epidermis. After a period of 2 to 3 months an adaptation to the altered salinity of the external medium was evident in that the tumorous tissue began to return to its original state.

80-001588 Piavis, G. W.; T. Beckerman and J. H. Howell. TERATOID LESIONS AND OTHER DEVELOPMENTAL ANOMALIES IN THE SEA LAMPREY, *PETROMYZON MARINUS* L. *J. Fish Dis.* 2(5):353-366. Sept. 1979. SFA 25(2)

[Dep. Anat., Baltimore Coll. Dental Surg., Dental Sch., Univ. Md., Baltimore 21201]

80-001589 Price, W. W. and R. A. Schlueter. OCCURRENCE OF THE PARASITE, *LIRONECA OVALIS* (ISOPODA: CYMOTHOIDAE) ON THE FISHES OF MCKAY BAY, TAMPA BAY SYSTEM, FL. *Fla. Sci.* 43(Suppl. 1):26. 1980. Abstract only. SFA 25(2)

[Univ. Tampa, Tampa, FL 33606] The isopod parasite, *Lironeca ovalis*, infested the gill cavities of 7 of 30 species of fish taken in biweekly seine collections from May 1977 to August 1978 in McKay Bay. The pinfish, *Lagodon rhomboides*, had the highest incidence rate (14.4%) followed by *Cyprinodon variegatus, Fundulus similis, Sciaenops ocellata, Leiostomus xanthurus, Floridicthys carpio* and *Fundulus grandis* (each <1%). Fish were infested from May-August only and incidence rates were highest in May and June for most species. Only female *L. ovalis* infested *L. rhomboides* and were most common on juveniles between 30-60 mm (SL). Over 50% of the females were ovigerous and carried 15 to 76 eggs/young per brood.

80-001590 Priemer, J. DARMHELMINTHEN VON *PERCA FLUVIATILIS* L. UND *ACERINA CERNUA* (L.) (PISCES) AUS GEWÄSSERN DER BERLINER RANDGEBIETES. [GUT HELMINTHS OF PERCH, *PERCA FLUVIATILIS* L. AND POPE, *ACERINA CERNUA* (L.) (PISCES) FROM LAKES ON THE OUTSKIRTS OF BERLIN.] *Zool. Anz.* 203(3/4):241-253. 1979. In German with English summ. SFA 25(2)

[Akad. Wissenschaften DDR, Berlin, West Germany]

80-001591 Raikova, E. V.; V. Ch. Suppes and G. L. Hoffman. THE PARASITIC COELENTERATE, *POLYPODIUM HYDRIFORME* USSOV, FROM THE EGGS OF THE AMERICAN ACIPENSERIFORM *POLYODON SPATHULA*. *J. Parasitol.* 65(5):804-810. Oct. 1979. SFA 25(2)

[Inst. Cytol. Acad. Sci., Leningrad 190121, USSR]

OTHER DISEASES AND PARASITES

80-001592 Rau, M. E.; D. M. Gordon and M. A. Curtis. BILATERAL ASYMMETRY OF *DIPLOSTOMUM* INFECTIONS IN THE EYES OF LAKE WHITEFISH *COREGONUS CLUPEAFORMIS* (MITCHILL) AND A COMPUTER SIMULATION OF THE OBSERVED METACERCARIAL DISTRIBUTION. *J. Fish Dis.* 2(4):291-297. July 1979. SFA 25(2)
[Inst. Parasitol., McGill Univ., Macdonald Coll. P.O. PQ H9X 1C0, Canada]

80-001593 Roald, S. O. and T. Håstein. LYMPHOSARCOMA IN AN ATLANTIC SALMON *SALMO SALAR* L. *J. Fish Dis.* 2(3):249-251. May 1979. SFA 25(2)
[Natl. Vet. Inst., P.B. 8156, Oslo 1, Norway]

80-001594 Roberts, R. J. and A. M. Bullock. PAPILLOMATOSIS IN MARINE CULTURED RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON. *J. Fish Dis.* 2(1):75-77. Jan. 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland]

80-001595 Roberts, R. J.; R. H. Richards and A. M. Bullock. PANSTEATITIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON: A CLINICAL AND HISTOPATHOLOGICAL STUDY. *J. Fish Dis.* 2(2):85-92. Mar. 1979. SFA 25(2)
[Unit Aquatic Pathobiol., Univ. Stirling, Stirling FK9 4LA, Scotland] Pansteatitis is a nutritionally mediated condition associated with the feeding of certain types of fish oil or unsaturated fatty acids of fish origin in a diet poor in vitamin E. It occurs regularly in mink, cats, pigs and poultry, all of which are fed on high fish diets, but this is the first description of the condition from cultured fish. The main presenting signs in affected rainbow trout were swimming aberrations, discolouration and high mortality after minimal stress. Gross post-mortem features were restricted to changes in the liver and swimbladder but, at the microscopic level, histopathological changes involving inflammatory cellular infiltration of lipid tissue in swimbladder, abdominal and peripancreatic fat and hypodermis, accompanied by myopathic changes, were regularly observed.

80-001596 Rollwagen, J. and D. Stainken. ECTOPARASITES AND FEEDING BEHAVIOR OF THE BLACKNOSE DACE, *RHINICHTHYS ATRATULUS* (CYPRINIDAE: CYPRINOFORMES) HERMANN. *Am. Midl. Nat.* 103(1):185-190. Jan. 1980. SFA 25(2)
[Dep. Biol., Manhattan Coll., Bronx, NY 10471]

80-001597 Sakaguchi, H. and A. Hamaguchi. [PHYSIOLOGICAL STUDIES ON CULTURED RED SEA BREAM--IV. PREVENTION OF GREEN LIVER AND CHANGES IN PLASMA CONSTITUENTS AND ENZYMATIC ACTIVITIES ON WINTER CULTURING IN WARM WATER.] *Bull. Jpn. Soc. Sci. Fish.* 45(11):1371-1373. Nov. 1979. In Japanese with English summ. SFA 25(2)
[Fac. Fish., Nagasaki Univ., Nagasaki 852, Japan] Separate groups of red sea bream, *Chrysophrys major*, were kept in cold water of an ambient temperature of 7.7-12.9°C and in warm water controlled at 18.0-19.5°C. After 5 and 11 weeks, the incidence of green liver was checked, and some of the chemical components and enzymatic activities of the plasma were analyzed. The incidence of green liver in the fish maintained at the elevated temperature was much less than that in the fish maintained in the natural cold environment. The cold water fish showed higher levels of triglyceride and higher glutamate-oxalacetate transaminase and lactate dehydrogenase activities even though results varied widely among individuals within a group. Alkaline phosphatase and inorganic phosphate levels were higher in the warm water fish. The levels of total cholesterol, glucose, calcium, and magnesium were approximately the same for both groups.

OTHER DISEASES AND PARASITES

80-001598 Schram, T. A. THE LIFE HISTORY OF THE EYE-MAGGOT OF THE SPRAT, *LERNAEENICUS SPRATTAE* (SOWERBY) (COPEPODA, LERNAEOCERIDAE). *Sarsia* 64(4):279-316. 1979. SFA 25(2)
[Inst. Marinbiol. Limnol., Univ. Oslo, P.O. Box 1064, Blindern, Oslo 3, Norway]

80-001599 Scott, A. L. and J. M. Grizzle. PATHOLOGY OF CYPRINID FISHES CAUSED BY *BOTHRIOCEPHALUS GOWKONGENSIS* YEA, 1955 (CESTODA: PSEUDOPHYLLIDEA). *J. Fish. Dis.* 2(1):69-73. Jan. 1979. SFA 25(2)
[J. M. Grizzle: Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830]

80-001600 Simpson, D. T. and J. L. McGraw, Jr. TWO NEW GENERA OF ASPIDOGASTERIDAE FROM *POGONIAS CROMIS* (L.) FROM THE TEXAS GULF COAST. *Southwest. Nat.* 24(4):557-562. 10 Dec. 1979. SFA 25(2)
[Dep. Immunol., Helena Lab., Beaumont, TX 77704]

80-001601 Sjöblom, V. and E. Kuittinen. *PHOCASCARIS* SP. (NEMATODA) LARVAE IN BALTIC HERRING, A NEW PARASITE FOR THE BALTIC SEA. *Finn. Fish. Res.* 2:1-3. 1978. SFA 25(2)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O.B. 193, SF-00131, Helsinki 13, Finland] Since larvae of *Anisakis* sp. (Nematoda) are frequently found in herring from the Southern Baltic Sea a search was made for parasite in fish caught off the Finnish coast. In all 3,500 Baltic herring were inspected after treatment with citric acidpepsin, but no *Anisakis* larvae were found. However, some fish contained larvae of *Phocascaris* sp. (Nematoda) a parasite new to the Baltic Sea. The prevalence of the species seems to be small, only 29 larvae were found.

80-001602 Sjöblom, V. and E. Kuittinen. FURTHER FINDS OF LARVAE OF *PHOCASCARIS* SP. (NEMATODA) IN BALTIC HERRING OFF THE COAST OF FINLAND. *Finn. Fish. Res.* 2:19-21. 1978. SFA 25(2)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O.B. 193, SF-00131, Helsinki 13, Finland]

80-001603 Smart, G. R.; D. Knox; J. G. Harrison; J. A. Ralph; R. H. Richards and C. B. Cowey. NEPHROCALCINOSIS IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON; THE EFFECT OF EXPOSURE TO ELEVATED CO_2 CONCENTRATIONS. *J. Fish Dis.* 2(4):279-289. July 1979. SFA 25(2)
[Shearwater Fish Farming, 109/111 Lowther St., Carlisle, Cumbria, England] Rainbow trout exposed to environmental free CO_2 concentrations ranging from 12-60 mg/l for a minimum of 275 days developed nephrocalcinosis. Gross histopathological and chemical examinations demonstrated that prevalence and severity of nephrocalcinosis increased with increasing CO_2 concentrations. The condition was characterized by calcification and granuloma formation in kidney and stomach. Diet, but not water, PO_4-P concentration appeared to modify the prevalence and severity at each CO_2 concentration tested.

80-001604 Smith, A. C. FORMATION OF LETHAL BLOOD CLOTS IN FISHES. *J. Fish Biol.* 16(1):1-4. Jan. 1980. SFA 25(2)
[Oceanoic Inst., Makapuu Point, Waimanalo, HI 96795]

OTHER DISEASES AND PARASITES

80-001605 Smith, C. E. THE PREVENTION OF LIVER LIPOID DEGENERATION (CEROIDOSIS) AND MICROCYTIC ANAEMIA IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON FED RANCID DIETS: A PRELIMINARY REPORT. *J. Fish Dis.* 2(5):429-437. Sept. 1979. SFA 25(2)

[U.S. FWS, Fish Cult. Dev. Cent., Bozeman, MT 59715] Feeding a rancid diet deficient in Vitamins C and E to 13 g rainbow trout resulted in growth depression, microcytic anaemia and liver lipoid generation. Trout fed the rancid diet containing Vitamins C and E grew as well as control fish fed a non-rancid diet and did not develop microcytic anaemia or liver lipoid degeneration. The symptoms that developed in deficient fish are typical of those resulting from Vitamin E but not Vitamin C deficiency. The results suggest that Vitamin E is important in preventing growth depression, microcytic anaemia and liver lipoid degeneration in rainbow trout fed rancid diets.

80-001606 Smith, C. E.; T. H. Peck; R. J. Klauda and J. B. McLaren. HEPATOMAS IN ATLANTIC TOMCOD *MICROGADUS TOMCOD* (WALBAUM) COLLECTED IN THE HUDSON RIVER ESTUARY IN NEW YORK. *J. Fish Dis.* 2(4):313-320. July 1979. SFA 25(2)

80-001607 Tareen, I. U. ABSCESSED BONY AREAS ON *ACANTHOPAGRUS CUVIERI* (DAY) AS A SUBSTRATE FOR EPIPHYTIC ALGAE. *J. Fish Biol.* 16(2):145-148. Feb. 1980. SFA 25(2)

[Maricult. Fish Dep., Kuwait Inst. Sci. Res., P.O. Box 36825, Raas, Kuwait] *Enteromorpha compressa* (L.) Greville and *E. clathrata* (J. Agardh), widely distributed green algae in Arabian Gulf, were observed growing on *Acanthopagrus cuvieri* (Day). Abscessed areas on the operculum provided suitable sites for attachment of both species of algae; broken spine tips were preferred by *E. compressa*. This study showed that these algae preferred hard substrata, with no scales for attachment. *E. compressa* appeared earlier and grew faster. The condition of the fish was normal.

80-001608 Valtonen, E. T. *NEOECHINORHYNCHUS RUTILI* (MÜLLER, 1780) (ACANTHOCEPHALA) IN THE WHITEFISH *COREGONUS NASUS* (PALLAS) *SENSU* SVÄRDSON FROM THE BAY OF BOTHNIA. *J. Fish Dis.* 2(2):99-103. Mar. 1979. SFA 25(2)

[Dep. Zool., Univ. Oulu, Kasarmintie 8, 90100 Oulu 10, Finland]

80-001609 Wales, J. H. INDUCTION OF HEPATOMA IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON BY THE EGG BATH TECHNIQUE. *J. Fish Dis.* 2(6):563-566. Nov. 1979. SFA 25(2)

[4390 Crescent Valley Dr., Corvallis, OR 97330]

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80-001610 Lindén, O.; R. Elmgren and P. Boehm. THE *TSESIS* OIL SPILL: ITS IMPACT ON THE COASTAL ECOSYSTEM OF THE BALTIC SEA. *Ambio* 8(6):244-253. 1979. SFA 25(2)

[Swed. Water Air Pollut. Res. Inst., Studsvik, S-611 82 Nyköping, Sweden]

POLLUTION

80-001611 Byers, S. C. and R. O. Brinkhurst, eds. REPORT ON OCEAN DUMPING R AND D PACIFIC REGION DEPARTMENT OF FISHERIES AND OCEANS 1978-1979. *Pac. Mar. Sci. Rep.* 79-18. iv + 59p. 1979. SFA 25(2)
[Dobrocky Seatech Ltd., Sidney, British Columbia, Canada]

80-001612 Cairns, T. and C. H. Parfitt. PERSISTENCE AND METABOLISM OF TDE IN CALIFORNIA CLEAR LAKE FISH. *Bull. Environ. Contam. Toxicol.* 24(4):504-510. Apr. 1980. SFA 25(2)
[Food Drug Admin., U.N. Plaza Fed. Off. Bldg., San Francisco, CA 94102]

80-001613 Casne, S. R.; J. G. Goyert and D. F. Hanson. ASSESSING THE IMPACT OF POWER PLANTS ON STRIPED BASS (*MORONE SAXATILIS*) IN THE SACRAMENTO-SAN JOAQUIN DELTA. *Cal-Neva Wildl.* 1979:69-73. 1979. SFA 25(2)
[Ecological Analysts, Inc., 1910 Olympic Blvd., Walnut Creek, CA 94596] A strategy for assessing the impact of power plants on striped bass (*Morone saxatilis*) of the Sacramento-San Joaquin river system is presented. The Strategy is divided into three assessment categories: 1) Direct involvement, 2) Short-term response, and 3) Long-term population consequences. Measures of impact within each of these categories are discussed with reference to theoretical development and data requirements. The end product of this strategy is a systems approach to impact assessment which places the role of the power plants in perspective to the behavior of the entire system.

80-001614 Cox, G. V.; A. Barnett; J. R. Gould; K. G. Hay; J. Hirota; C. D. McAuliffe and A. D. Michael. OIL SPILL STUDIES: STRATEGIES AND TECHNIQUES. *J. Environ. Pathol. Toxicol.* 3(1/2):1-148. Dec. 1979. SFA 25(2)

80-001615 Crandall, P. S. EVALUATION OF STRIPED BASS X WHITE BASS HYBRIDS IN A HEATED TEXAS RESERVOIR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:588-598. 1978[1979] SFA 25(2)
[Tex. Parks Wildl. Dep., Ingram 78025] This study was conducted to identify habitat factors responsible for the success or failure of a striped bass (*Morone saxatilis*) x white bass (*Morone chrysops*) hybrid introduction and to measure fisherman benefits from the stocking. Hybrids were introduced into Lake Bastrop, Texas, at a rate of approximately 25 fish/ha in 1973, 1974, and 1975. From 1973 through 1977 water samples were analyzed to monitor physicochemical conditions; seining, gillnetting and cove rotenone sampling were accomplished to estimate composition of fish populations; and creel surveys were conducted to measure fisherman effort and harvest. Hybrids exhibited high survival rates but apparently there was insufficient forage to sustain their initial rapid growth. Despite this condition, hybrids attained weights up to 2.0 kg and provided substantial fisherman benefits in terms of harvest and recreation. The monetary value of these benefits was approximately 12 times greater than the costs of the hybrid introduction.

80-001616 Cumbie, P. M. and S. L. Van Horn. SELENIUM ACCUMULATION ASSOCIATED WITH FISH MORTALITY AND REPRODUCTIVE FAILURE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:612-624. 1978[1979]. SFA 25(2)
[Design Eng. Dep., Duke Power Co., P.O. Box 33189, Charlotte, NC 28242] Fish populations of Belews Lake, North Carolina, declined during the period of operation of the Belews Creek Steam Station from 1974 through 1977. Reproduction of fish in the main lake was almost completely absent in 1976 and 1977. A survey of trace elements in water and fish from Belews Lake indicated that selenium concentrations were elevated in Belews Lake water, and that fish in the lake had accumulated unusual amounts of selenium. Fish from a remote area of Belews Lake where normal reproduction took place in 1976 and 1977 had much lower selenium concentrations in their tissues than

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80-001616 CONTINUED fish from the main basin. Only trace elements of selenium occur naturally in water, soil, or mineral deposits in the Belews Lake drainage. Selenium entered Belews lake in soluble form by way of the power plant fly ash sluice water return. Selenium concentrations in Belews Lake water were not high enough to be directly toxic to fish. Uptake by plankton introduced selenium to the food chain where it ultimately reached elevated levels in fish due to bioaccumulation. Selenium is known to interfere with reproduction in animals, and is considered to be the most probable cause of reduced fish reproduction in Belews Lake. The North Carolina Department of Natural Resources and Community Development and Duke Power Company have taken action to reduce inputs of selenium to Belews Lake.

80-001617 Doyle, R. T.; J. V. Merriner and M. E. Bender. DEPURATION OF KEPONE BY ATLANTIC CROAKER IN A LABORATORY STUDY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:514-516. 1978[1979]. SFA 25(2)
[Va. Inst. Mar. Sci., Coll. William and Mary, Gloucester Point, 23062] Contamination of the James River in Virginia by the organochlorine pesticide Kepone® prompted depuration studies of commercially important species. Approximately 400 croaker (*Micropogonias undulatus*) were taken from the James River and placed in Kepone-free York River water. Groups of 20 fish, maintained at ambient temperature, were sampled over time to determine depuration rate. Results suggest that there is no substantial depuration of Kepone by croaker until water temperature exceeds 15 C.

80-001618 Eagle, R. A.; P. A. Hardiman; M. G. Norton; R. S. Nunny and M. S. Rolfe. THE FIELD ASSESSMENT OF EFFECTS OF DUMPING WASTES AT SEA: 5. THE DISPOSAL OF SOLID WASTES OFF THE NORTH-EAST COAST OF ENGLAND. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 51. 34p. 1979. SFA 25(2)
[M. G. Norton: Fish. Lab., Burnham-on-Crouch, England]

80-001619 Finlayson, B. and D. Wilson. ACID-MINE WASTE--HOW IT AFFECTS KING SALMON IN THE UPPER SACRAMENTO RIVER. *Outdoor Calif.* 40(6):8-12. Nov.-Dec. 1979. SFA 25(2)
[Calif. Dep. Fish Game, Water Pollut. Control Lab., Rancho Cordova]

80-001620 Folmar, L. C. EFFECTS OF SHORT-TERM FIELD APPLICATIONS OF ACROLEIN AND 2,4-D (DMA) ON FLAVOR OF THE FLESH OF RAINBOW TROUT. *Bull. Environ. Contam. Toxicol.* 24(2):217-224. Feb. 1980. SFA 25(2)
[U.S. FWS, Fish-Pestic. Res. Unit, Denver Fed. Cent., Denver, CO 80225]

80-001621 Forester, R. T. GEOTHERMAL ENERGY AND THE ENVIRONMENT. *Cal-Neva Wildl.* 1979:78-82. 1979. SFA 25(2)
By the year 2020 the world's presently identified oil reserves will be depleted. The United States has developed a National Energy Plan to conserve remaining oil supplies, reduce dependency on foreign oil supplies, and develop non-conventional energy sources, including geothermal. Geothermal energy could account for 4% of the nation's electrical energy production by 1990. Geothermal resources can be divided into the following types a) vapor dominated, b) liquid dominated, c) geopressure, d) hot dry rock, and e) Magma. Approximately 1.4 million ha of land have been designated by the U.S. Geological Survey as Known Geothermal Resource Areas (KGRA). California and Nevada account for 60% of the KGRA lands. 502 mw of electrical energy is now

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80-001621 CONTINUED being produced at the Geysers KGRA. To operate one 110 mw geothermal power plant in The Geysers requires between 16-35 steam wells producing a total of 900,000 kgs of steam per hour for the 30 year life of the plant. The 110 mw power plant and attendant steam wells encompasses about 280 ha of land. Direct utilization of geothermal energy (nonelectric) is in its infancy in the United States. Geothermal resources with temperature less than 150 C can be used for greenhousing, fruit and vegetable dehydration space heating and aquaculture. The statement that geothermal energy production is nonpolluting is not entirely correct. Geothermal energy development has inherent restrictions and environmental problems, including site specificity; heat loss during steam/fluid transmission; extensive road, steam and electric transmission line networks; moderate land disturbance, up to 20% of the surface area, and potential air and water quality tradeoffs. Mitigation measures for wildlife habitat losses are generally restricted to revegetation of some denuded areas. In order to better assess the impacts to fish and wildlife resources resulting from geothermal development, baseline data are needed prior to exploration and development activities.

80-001622 Gover, J. W. CONCENTRATIONS OF ARSENIC, SELENIUM AND TEN HEAVY METALS IN SCHOOL SHARK, *GALEORHINUS AUSTRALIS* (MACLEAY), AND GUMMY SHARK, *MUSTELUS ANTARCTICUS* GÜNTHER, FROM SOUTH-EASTERN AUSTRALIAN WATERS. *Aust. J. Mar. Freshwater Res.* 30(4):505-510. Aug. 1979. SFA 25(2)

[Fish. Wildl. Div., Arthur Rylah Inst. Environ. Res., Brown St., Heidelberg, Victoria 3084, Australia] The maximum concentrations of arsenic, cadmium, copper, manganese, selenium and zinc in the edible flesh of *G. australis* and *M. antarcticus* were found to be 30, 0.08, 0.6, 0.6, 0.8 and 4.8 µg/g, wet weight respectively. The concentrations of cobalt, chromium, lead, molybdenum and nickel were below the limits of detection, namely 0.3, 0.5, 0.1, 0.2 and 0.2 µg/g, wet weight respectively, of the methods used. Samples for analysis were taken from one male and one female shark of each species caught in six areas in south-eastern Australian waters and wherever possible the concentrations of the elements were correlated with the sharks' species, sex and site of capture.

80-001623 Harrell, R. D.; R. L. Fuller and T. J. Edwards. AN INVESTIGATION OF THE FISH COMMUNITY OF BELEWS LAKE, NORTH CAROLINA. *Duke Power Co., Charlotte, N. C.* DUKE PWR/78-07. 64p. Oct. 1978. SFA 25(2)

[Duke Power Co., Charlotte, NC] Belews Lake provides a source of cooling water for the Belews Creek Steam Station (BCSS) located in Stokes County, North Carolina. This study, begun in 1976, was a continuation of a fish population evaluation study initiated by the North Carolina Wildlife Resources Commission (NCWRC) in 1971. This study revealed that the upper area of Belews Lake sustains an abundant and diverse adult and larval fish community, while the lower Belews Lake area supports few adult and larval fishes and exhibits little species diversity. Effects of the BCSS thermal discharges on the fishes of Belews Lake were limited to a general avoidance of the heated areas during the summer and fall months. Belews Lake flat bullheads generally grew faster and weighed slightly more than Lake Norman bullheads. Belews Lake bluegill grew slightly slower than those of most other North Carolina lakes and consistently weighed less than fish of equal lengths from other waters. Flat bullheads, green sunfish, and bluegill fed mainly on aquatic invertebrates (primarily insects).

80-001624 Haynes, R. J. THE SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977 AND POTENTIAL IMPACTS ON FISH AND WILDLIFE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:790-796. 1978[1979] SFA 25(2)

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80-001624 CONTINUED
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830] The Surface Mining Control and Reclamation Act of 1977 was enacted into law on 3 August 1977. Successful implementation and enforcement of the environmental performance standards of the Act will reduce or eliminate many of the previously recognized environmental perturbations of surface mining, and will result in numerous positive benefits for fish and wildlife. However, fish and wildlife will continue to be adversely affected by surface mining due to losses of specific habitat types and reclamations which result in postmining changes in habitat type and interspersion of habitats. The proposed program for reclaiming abandoned mine lands has great potential for benefiting fish and wildlife, but the actual benefit or loss will depend upon the conditions of each mine site and the site-specific reclamation plan authorized. Knowledgeable personnel within fish and wildlife management agencies will be charged with most of the responsibility for ensuring protection and equal consideration for the needs of fish and wildlife in proposed reclamation plans.

80-001625 Hubert, W. A. ALDRIN AND DDT RESIDUES IN CARP FROM IMPOUNDED AND RIVERINE SEGMENTS OF THE DES MOINES RIVER, 1979. *Proc. Iowa Acad. Sci.* 87(1):12. Mar. 1980. Abstract only. SFA 25(2)
[Iowa Coop. Fish. Res. Unit, Iowa State Univ., Ames 50011]

80-001626 Jacobsen, O. J. NOEN SYNSPUNKTER PÅ FORHOLDET FISK-SURT VANN. [SOME ASPECTS OF THE RELATION BETWEEN FISH AND ACID WATER] *Fauna (Oslo)* 31(1)1-10. 1978. In Norwegian with English summ. SFA 25(2)
[Zool. Inst., Box 1050, Univ. Oslo, Blindern, Oslo 3, Norway]

80-001627 Kauffman, J. EFFECT OF A MERCURY-INDUCED CONSUMPTION BAN ON ANGLING PRESSURE: SOUTH FORK OF THE SHENANDOAH RIVER, VIRGINIA. *Fisheries (Bull. Am. Fish. Soc.)* 5(1):10-12. Jan.-Feb. 1980. SFA 25(2)
[P.O. Box 66, Free Union, VA 22940] Consumption of fish from the South Fork of the Shenandoah River was banned in June 1977 as a result of high mercury levels in the fish. Fishing pressure declined dramatically after the ban's announcement. Pressure decreased by 74% the first year, and economic losses to local communities amounted to more than $432,000. However, by the beginning of the second year fishing pressure had returned nearly to normal.

80-001628 Kureishy, T. W.; M. D. George and R. S. Gupta. TOTAL MERCURY CONTENT IN SOME MARINE FISH FROM THE INDIAN OCEAN. *Mar. Pollut. Bull.* 10(12):357-360. Dec. 1979. SFA 25(2)
[Natl. Inst. Oceanogr., Dona Paula, Joa 403 004, India] Total mercury was estimated in liver, gonads and muscle of some of the marine fishes from the Indian Ocean. The highest mercury concentration was observed in the muscle of sharks while the total mercury concentration was practically non-detectable in the liver and gonads. The range of all the values was 0.09-0.21 ppm (wet weight basis) and is quite low to reflect any possible mercury contamination.

80-001629 Lanigham, M. C. ZINC DYNAMICS IN AN ARTIFICIAL FRESHWATER ECOSYSTEM. *Ph.D. dissertation, State Univ. N.Y. (Buffalo)* 251p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(9):4103. Mar. 1980. SFA 25(2)

80-001630 Lewis, W. M., Jr. and M. C. Grant. ACID PRECIPITATION IN THE WESTERN UNITED STATES. *Science* 207(4427):176-177. 11 Jan. 1980. SFA 25(2)
[Dep. Environ. Popul. Organ. Biol., Univ. Colo., Boulder 80309]

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80-001630 CONTINUED Precipitation chemistry data from a rural area at an elevation of 2900 meters near the Continental Divide in Colorado show unexpectedly low pH values for bulk precipitation. A significant downward trend in pH over the last 3 years is associated with increasing amounts of nitric acid in precipitation.

80-001631 Marble, A. D. IDENTIFICATION AND ASSESSMENT OF AQUATIC RESOURCES FOR POWER PLANT SITES ON MARYLAND'S EASTERN SHORE. *Coast. Zone Manage. J. (Copywrite Crane, Russak & Co., N.Y.)* 7(1):49-70. 1980. SFA 25(2)

[Rogers & Golden, Philadelphia, PA] A power plant siting procedure which accounts for the protection and preservation of aquatic resources, defined as sensitive life forms and life stages of economically valuable species of finfish and shellfish, is presented as it was executed on Maryland's Eastern Shore. Negative effects of power plant development and operation are generated principally by the cooling water intake and discharge system. The site-selection procedure is thus presented as a two-faceted process, termed regional screening, requiring the separate but simultaneous identification of land-based sites and cooling systems. Criteria included in regional screening for cooling systems reflected life-sustaining processes essential to the maintenance of aquatic resources. Major sources of effects of power plants on aquatic resources and siting principles as they affect aquatic resources are defined. Information-gathering techniques included extensive interviews with key research scientists, state personnel, and numerous Chesapeake Bay watermen.

80-001632 Merna, J. W. INTRODUCTION OF CHLORINATED HYDROCARBONS INTO STREAM FISHES BY SPAWNING SALMON. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1878. 25p. 28 Dec. 1979. SFA 25(2)

[Inst. Fish. Res., Mus. Annex, Ann Arbor, MI 48103] The extent of contamination with chlorinated hydrocarbons of trout resident in two small streams by spawning coho and chinook salmon was determined. An attempt was made to trace PCB, DDT, and dieldrin through the aquatic system following their release from decaying salmon carcasses. No retention of contaminants within the food chain was found. Analysis of stream sediments and crayfish failed to reveal measurable concentrations. However, trout, and to a lesser extent sculpins, accumulated PCB and DDT as a result of eating contaminated salmon eggs. Eggs constituted as much as 87% (by weight) of the total stomach contents of trout collected during the salmon spawning season. The PCB level in salmon eggs ranged from 0.46 to 9.50 ppm, and they were found in trout stomachs from early October to early January. Thus the diet of trout carried a significant level of contamination for a period of at least 90 days. Utilization of eggs was highly variable among individual trout, and there was a strong correlation between numbers of eggs in the stomachs and PCB levels in the fillets. Concentrations of chlorinated hydrocarbons in trout fillets ranged from 0.20 to 4.63 ppm of PCB and 0.11 to 2.52 ppm of DDT. These materials were never detected in samples from the control stream.

80-001633 Miyazaki, T.; K. Akiyama; S. Kaneko; S. Horii and T. Yamagishi. IDENTIFICATION OF CHLORDANES AND RELATED COMPOUNDS IN GOBY-FISH FROM TOKYO BAY. *Bull. Environ. Contam. Toxicol.* 24(1):1-8. Jan. 1980. SFA 25(2)

[Tokyo Metro. Res. Lab. Pub. Health, 24-1, 3-chome, Hyakunincho, Shinjuku-ku, Tokyo, 160 Japan]

80-001634 Moore, L. F. FISHERIES CONSIDERATIONS IN SETTING TEMPERATURE GUIDELINES FOR POWER STATIONS. *Rev. Can. Biol.* 38(4):293-299. Dec. 1979. In English with French summ. SFA 25(2)

POLLUTION

80-001634 CONTINUED
[Ontario Minist. Environ., Water Resour. Br., 135 St. Clair Ave, Toronto, Canada]

80-001635 Murray, L. A. and M. G. Norton. THE COMPOSITION OF DREDGED SPOILS DUMPED AT SEA FROM ENGLAND AND WALES. *Fish. Res. Tech. Rep. Minist. Agric. Fish. Food (Lowestoft)* No. 52. 10p. 1979. SFA 25(2)
[Fish. Lab., Burnham-on-Crouch, England]

80-001636 Parris, G. E.; G. W. Diachenko; R. C. Entz; J. A. Poppiti; P. Lombardo; T. K. Rohrer and J. L. Hesse. WATERBORNE METHYLENE *BIS*(2-CHLOROANILINE) AND 2-CHLOROANILINE CONTAMINATION AROUND ADRIAN, MICHIGAN. *Bull. Environ. Contam. Toxicol.* 24(4):497-503. Apr. 1980. SFA 25(2)
[Div. Chem. Technol. (HFF-420), Food Drug Admin., Washington, DC 20204]

80-001637 Phillips, G. R. and D. R. Buhler. MERCURY ACCUMULATION IN AND GROWTH RATE OF RAINBOW TROUT, *SALMO GAIRDNERI*, STOCKED IN AN EASTERN OREGON RESERVOIR. *Arch. Environ. Contam. Toxicol.* 9(1):99-107. 1980. SFA 25(2)
[Coop. Fish. Res. Unit, Mont. State Univ., Bozeman 59717]

80-001638 Platts, W. S.: S. B. Martin and E. R. J. Primbs. WATER QUALITY IN AN IDAHO STREAM DEGRADED BY ACID MINE WATER. *U.S. For. Serv. Intermountain For. Range Exp. Stn. Gen. Tech. Rep.* GTR-INT-67. 1980. SFA 25(2)
[U.S. For. Serv., Intermountain For. Range Exp. Stn., 316 E. Myrtle St., Boise, ID 83706] The loss of a valuable salmonid fish population in the Panther Creek drainage of east-central Idaho led to studies designed to identify the source of toxic materials in the drainage. Numerous studies summarized here indicate that water seepage from adits of the no longer operating Blackbird Mine and leaching from mine waste piles are the principal sources of cobalt, copper, iron, manganese, lead, and zinc in the drainage. Downstream from the mined area, pH values have been lowered to levels lethal to aquatic organisms. High sediment loads in area streams are probably the result of stream scouring below the mined area. Sampling of the drainage yielded no fish nor aquatic insects in areas affected by mining. Upstream from mined areas, diverse populations of both fish and insects existed. Tests showed that trout fingerlings placed downstream from the mined area were killed. Elimination of fish populations from waters altered by mining in the Panther Creek drainage is proably the result of the long-term, chronic effects of heavy metal toxicity. Pollution from the mine, waste dumps, and tailings ponds will remain in the drainage until these areas are rehabilitated.

80-001639 Ramamurthy, V. D. BASELINE STUDY OF THE LEVEL OF CONCENTRATION OF MERCURY IN THE FOOD FISHES OF BAY OF BENGAL, ARABIAN SEA AND INDIAN OCEAN. *Bull. Jpn. Soc. Sci. Fish.* 45(11):1405-1407. Nov. 1979. SFA 25(2)
[Inspection Lab., Mar. Prod. Export Dev. Auth., Wellington Island, Cochin 682 003, India]

POLLUTION

80-001640 Settle, D. M. and C. C. Patterson. LEAD IN ALBACORE: GUIDE TO LEAD POLLUTION IN AMERICANS. *Science* 207(4436):1167-1176. 14 Mar. 1980. SFA 25(2)
[Div. Geol. Planetary Sci., Calif. Inst. Technol., Pasadena 91125]

80-001641 Shapot, R. M. INITIAL POWER PLANT EFFECTS ON FISH DISTRIBUTION IN A SMALL FLORIDA ESTUARY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:529-546. 1978[1979]. SFA 25(2)
[Ecol. Serv., Texas Instruments Inc., P.O. Box 237, Buchanan, NY 10511]

80-001642 Thomas, J. M. and D. H. McKenzie. A PROCEDURE FOR ASSESSING BIOLOGICAL EFFECTS OF POWER PLANTS ON FISH. *Fisheries (Bull. Am. Fish. Soc.)* 4(6):23-27. Nov.-Dec. 1979. SFA 25(2)
[Ecol. Sci. Dep., Battelle Northwest Lab., Richlands, WA]

80-001643 Watanabe, N; Y. Ishimaru; N. Ishida; Y. Katayama and S. Kitayama. [THE USE OF ISAZA (*CHAENOGOBIUS ISAZA* TANAKA) TO STUDY THE PCB POLLUTION.] *Jpn. J. Limnol.* 40(2):66-73. Apr. 1979. In Japanese with English summ. SFA 25(2)
[Kobe Commer. High Sch., Tarumi-ku, Kobe 654, Japan]

80-001644 Westernhagen, H. v.; V. Dethlefsen and H. Rosenthal. CORRELATION BETWEEN CADMIUM CONCENTRATION IN THE WATER AND TISSUE RESIDUE LEVELS IN DAB, *LIMANDA LIMANDA* L., AND PLAICE, *PLEURONECTES PLATESSA* L. *J. Mar. Biol. Assoc. UK* 60(1):45-58. Feb. 1980. SFA 25(2)
[Biol. Anat. Helgoland, Palmaille 9, 2 Hamburg 50, West Germany] Juvenile dab, *Limanda limanda* L., and plaice, *Pleuronectes platessa* L., were kept in cadmium contaminated (5 µg/l, 50 µg/l) flow-through systems for 6 and 96 days. Accumulation of cadmium was measured in backbone, fins, gills, liver, muscle (fillet), otoliths and skin (dorsal and ventral). At both cadmium concentrations there was measurable accumulation after 6 days and significant accumulation in liver and gills after 96 days. At 50 µg/l, except for otoliths, all tissues tested showed significant uptake of cadmium. Growth and condition factors were not affected by either cadmium concentration. At 50 µg/l there was extensive mortality and plaice developed fin erosion.

80-001645 Winner, R. W.; M. W. Boesel and M. P. Farrell. INSECT COMMUNITY STRUCTURE AS AN INDEX OF HEAVY-METAL POLLUTION IN LOTIC ECOSYSTEMS. *Can. J. Fish. Aquatic Sci.* 37(4):647-655. Apr. 1980. SFA 25(2)
[Dep. Zool., Miami Univ., Oxford, OH 45056]

FISH KILLS

80-001646 Bruton, M. N. and R. H. Taylor. CICHLID FISH MORTALITY IN A FRESHWATER LAKE IN NATAL. *Lammergeyer* 27:1-4. Oct. 1979. SFA 25(2)
[Rhodes Univ., South Africa] A mortality of the cichlid fish *Sarotherodon mossambicus* in association with relatively low water temperatures (<13°C) was recorded in a freshwater lake in Natal during June/July 1978. The locality was near the southernmost boundary of natural freshwater populations of *S. mossambicus*, which extends further south in estuaries due to its greater ability to tolerate low temperatures in brackish water.

FISH KILLS

80-001647 Haslouer, S. G. NATURAL AND POLLUTION-CAUSED FISH KILLS IN KANSAS DURING 1978. *Trans. Kans. Acad. Sci.* 82:197-204. 1979. SFA 25(2)

[Div. Environ., Kans. Dep. Health Environ., Topeka 66620] Thirty-four fish kills were reported to the Kansas Department of Health and Environment in 1978. Of these, eleven were determined to have been resultant of natural causes. The remaining twenty-three are either known or suspected to have been caused by man-made pollutants or activities. Where causes were identified, agricultural and industrial oeprations led municipal operations in numbers of pollution-related kills, producing six incidents each. The five fish kills associated with municipal sewage treatment plants and (in one case) water treatment plants accounted for 15 percent of reported 1978 fish kills. The six reports in the unknown (unidentifiable) operations category represented 18 percent of all investigations. In most of these cases intensive investigation was not possible due to late notification of our offices and the transient nature of many pollutants. Agricultural operations killed more fish than any other pollution source in 1978. The 37,827 fish killed by feedlot runoff and other farming activities represent 73 percent of the 51,569 fish killed by pollution last year. The eleven incidents of natural mortalities investigated resulted in the death of 24,955 fish, a full 33 percent of the 76,524 fish which died in the kills reported. The majority of the reports (64 percent) indicate that less than 1000 fish were killed per incident in 1978. Thirty percent of the kills involved 1,000-10,000 fish, and 6 percent (two incidents) involved more than 10,000 fish.

80-001648 Martin, B. B. and D. F. Martin. ROTENONE AS A CAUSATIVE AGENT IN THE MASS MORTALITY OF WHITE AMUR IN AN ORANGE COUNTY, FLORIDA POND. *J. Environ. Sci. Health A Environ. Sci. Eng. (Marcel Dekker, Inc., N.Y.)* 14(8):709-715. 1979. SFA 25(2)

[Dep. Chem., Univ. South Fla., Tampa 33620] Water taken some two days after a mass mortality of white amur in an Orange County, Florida, holding pond was extracted with chloroform. The concentrated extracts were analyzed by high pressure liquid chromatography (HPLC) and were found to contain rotenone, a known fish toxicant, upon comparison with an authentic sample. The water contained, by estimation, 1.8 ppm rotenone. Additional studies were made of the degradation of rotenone and associated materials of commercial samples in lake water in contact with sediment. The carrier materials degrade rapidly, i.e., within two days, though rotenone should persist for purposes of HPLC analysis for two days under ambient environmental conditions. The origin of rotenone in this water is unknown.

TOXICOLOGY; BIOASSAYS

80-001649 Demaël, A.; D. Garin and G. Pérès. RESPONSE OF THE TENCH (*TINCA TINCA* L.) TO POTASSIUM NITRATE ENRICHED WATER. *J. Fish Biol.* 16(1):15-22. Jan. 1980. SFA 25(2)

[Lab. Physiol. Gen. Comp., Univ. Claude Bernard, Lyon I, Villeurbanne, France] When the tench (*Tinca tinca* L.) was exposed to a slight increase, 8.5 mg/l, in the potassium content of the water, metabolic and hormonal changes occurred which lasted more than four weeks. An initial phase of lipolysis was followed by a partial consumption of glycogen reserves, which in turn was followed by a phase of gluconeogenesis. Hyperglycaemia persisted throughout the experiment. The ion distribution in erythrocytes and liver changed relatively early; there was no observable change in water content. These changes are similar to those observed during the osmoregulation of fish.

80-001650 Adeney, R. J. and P. Matthiessen. SUB-LETHAL EFFECTS OF THE ORGANOPHOSPHATE BLACKFLY LARVICIDE, ABATE (TEMEPHOS) ON *SAROTHERODON MOSSAMBICUS* (PETERS). *J. Fish Biol.* 15(5):545-553. Nov. 1979. SFA 25(2)

TOXICOLOGY; BIOASSAYS

80-001650 CONTINUED
[Cent. Overseas Pest Res., Overseas Dev. Admin., Coll. House, Wrights Lane, London W8 5SJ, England] *Sarotherodon mossambicus* was exposed for up to 10 weeks to concentrations of Abate larvicide in excess of those produced during blackfly control in African rivers. Despite this treatment, several indicators of sub-lethal poisoning, e.g. growth, plasma glucose, acetylcholinesterase activity remained almost unchanged. A possible explanation for the low toxicity of Abate is given.

80-001651 Alabaster, J. S.; D. G. Shurben and G. Knowles. THE EFFECT OF DISSOLVED OXYGEN AND SALINITY ON THE TOXICITY OF AMMONIA TO SMOLTS OF SALMON, *SALMO SALAR* L. *J. Fish Biol.* 15(6):705-712. Dec. 1979. SFA 25(2)
[Water Res. Cent., Stevenage Lab., Elder Way, Stevenage, Herts. SG1 1TH, England]

80-001652 Anderson, A. D.; M. E. Lebsack; G. M. DeGraeve; D. S. Farrier and H. L. Bergman. TOXICITY OF AN *IN SITU* OIL SHALE PROCESS WATER TO RAINBOW TROUT AND FATHEAD MINNOWS. *Arch. Environ. Contam. Toxicol.* 9(2):171-179. 1980. SFA 25(2)
[Sch. Pharm., Univ. Wyo., Box 3375, University Station, Laramie 82071]

80-001653 Andros, J. D. and R. R. Garton. ACUTE LETHALITY OF COPPER, CADMIUM, AND ZINC TO NORTHERN SQUAWFISH. *Trans. Am. Fish. Soc.* 109(2):235-238. Mar. 1980. SFA 25(2)
[U.S. EPA, West. Fish Toxicol. Stn., Corvallis, OR 97330]

80-001654 Bolis, L. and J. C. Rankin. INTERACTIONS BETWEEN VASCULAR ACTIONS OF DETERGENT AND CATECHOLAMINES IN PERFUSED GILLS OF EUROPEAN EEL, *ANGUILLA ANGUILLA* L. AND BROWN TROUT, *SALMO TRUTTA* L. *J. Fish Biol.* 16(1):61-73. Jan. 1980. SFA 25(2)
[Dep. Physiol., Univ. Messina, 5 Via del Vespro, Messina, Italy] Noradrenaline induced vasodilation in isolated perfused eel or trout gills was inhibited by propranolol, a β-adrenergic blocking agent. The noradrenaline effect was much reduced in gills of fish which had been kept in 1 mg/l solutions of the detergent LAS (linear alkylate sulphonate; 12C chain length). LAS produced concentration-dependent vasodilation, which was inhibited by propranolol, in eel and trout gills. Noradrenaline produced additional vasodilation in eel and trout gills which had been dilated by $2 \cdot 1/10^8$M LAS but had no effect on trout gills perfused with $2 \cdot 1/10^7$M LAS. Gills from trout which had been kept in 0.1 mg/l LAS responded to noradrenaline normally but the propranolol inhibition appeared to be potentiated.

80-001655 Borgmann, U.; R. Cove and C. Loveridge. EFFECT OF METALS ON THE BIOMASS PRODUCTION KINETICS OF FRESHWATER COPEPODS. *Can. J. Fish. Aquatic Sci.* 37(4):567-575. Apr. 1980. SFA 25(2)
[Great Lakes Biolimnol. Lab., Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

80-001656 Brenniman, G. R.; M. R. Anver; R. Hartung and S. H. Rosenberg. EFFECTS OF OUTBOARD MOTOR EXHAUST EMISSIONS ON GOLDFISH *(CARASSIUS AURATUS)*. *J. Environ. Pathol. Toxicol.* 2(6):1267-1281. July-Aug. 1979.

TOXICOLOGY; BIOASSAYS

80-001656 CONTINUED SFA 25(2)
[Environ. Health Sci., Sch. Pub. Health, Univ. Ill. Med. Cent., Chicago 60680] Goldfish (*Carassius auratus*) were exposed to outboard exhaust products in water or to toluene (a constituent of outboard motor exhaust water) via a continuous flow bioassay dosing apparatus. Various physiologic and pathologic changes were noted. In the blood a consistent decrease ($p<0.05$) in the partial pressure of oxygen, a significant increase ($p<0.05$) in the partial pressures of carbon dioxide, and significant decreases ($p<0.05$) in pH and oxygen saturation were found in many of the blood gas experiments. Laboratory experiments also indicated that these fish are capable of metabolizing toluene to hippuric acid ($p<0.05$). Exposure up to 30 days to these exhaust products produced gross and microscopic lesions in the high-, intermediate-, and low-dose fish. Grossly, livers were smaller and pale; intestines were empty of ingesta and feces; and gills were coated excessively with mucus. Microscopically, the livers of the exposed fish had a decreased cytoplasmic:nuclear ratio, gill filaments were fused, and some kidneys had tubular vacuolization.

80-001657 Califano, R. J.; J. M. O'Connor and L. S. Peters. UPTAKE, RETENTION, AND ELIMINATION OF PCB (AROCLOR 1254) BY LARVAL STRIPED BASS (*MORONE SAXATILIS*). *Bull. Environ. Contam. Toxicol.* 24(3):467-472. Mar. 1980. SFA 25(2)
[N.Y. Univ. Med. Cent., Inst. Environ. Med., A. J. Lanza Lab., Tuxedo 10987]

80-001658 Cameron, J. A. and R. L. Smith. ULTRASTRUCTURAL EFFECTS OF CRUDE OIL ON EARLY LIFE STAGES OF PACIFIC HERRING. *Trans. Am. Fish. Soc.* 109(2):224-228. Mar. 1980. SFA 25(2)
[Inst. Mar. Sci., Univ. Alaska, Fairbanks 99701]

80-001659 Colwell, A. E. and C. H. Schaefer. DIETS OF *ICTALURUS NEBULOSUS* AND *POMOXIS NIGROMACULATUS* ALTERED BY DIFLUBENZURON. *Can. J. Fish. Aquatic Sci.* 37(4):632-639. Apr. 1980. SFA 25(2)
[Lake County Mosquito Abatement Dist., Lakeport, CA 95453]

80-001660 Couch, J. A.; J. T. Winstead; D. J. Hansen and L. R. Goodman. VERTEBRAL DYSPLASIA IN YOUNG FISH EXPOSED TO THE HERBICIDE TRIFLURALIN. *J. Fish. Dis.* 2(1):35-42. Jan. 1979. SFA 25(2)
[U.S. EPA, Gulf Breeze Environ. Res. Lab., Gulf Breeze, FL 32561] Sheepshead minnows, *Cyprinodon variegatus* Lacépède, exposed to 5.5 to 31 µg/l of the herbicide trifluralin, throughout their first 28 days of life, developed a heretofore undescribed vertebral dysplasia. This dysplasia consisted of semi-symmetrical hypertrophy of vertebrae (three to 20 times normal), characterized by foci of osteoblast and fibroblasts actively laying down bone and bone precursors. Effects of the abnormal vertebral development were dorsal vertebral growth into the neural canal, ventral compression of renal ducts, and longitudinal fusion of vertebrae. Fish, exposed for 51 days to 16.6 µg/l trifluralin and thereafter depurated for 41 days, showed no increase in vertebral dysplasia during dupuration; however, residual spinal column damage was evident. Serum calcium concentrations were elevated in adult fish exposed for 4 days to 16.6 µg/l trifluralin. Fluorosis or mimicry of hypervitaminosis A are considered possible mechanisms for the osseous effect, but are not considered to be the only possible causes. The highly predictable nature of this disorder in experimental exposures strengthens the probability that young fish may serve as experimental models for determining effects of chemicals on early vertebrate ontogeny, particularly in regard to skeletal development.

TOXICOLOGY; BIOASSAYS

80-001661 Das, K. K.; S. G. Dastidae; S. Chakrabarty and S. K. Banerjee. TOXICITY OF MERCURY: A COMPARATIVE STUDY IN AIR-BREATHING AND NON AIR-BREATHING FISH. *Hydrobiologia* 68(3):225-229. 16 Feb. 1980. SFA 25(2)
[Dep. Biochem., Univ. Coll. Sci. Calcutta 700 019, India] In a mercury polluted environment, air-breathing fishes are more resistant towards mercury toxicity than the non air-breathing fishes as regards their duration of survival and growth. Under sub-acute levels of mercury exposure, they respond differently in so far as the activities of their liver, gill and intestinal lysosomal enzymes and liver microsomal enzymes are concerned. Alteration in the levels of liver microsomal glucose-6-phosphatase, serum glucose and liver glycogen indicate that carbohydrate metabolism is impaired under the above experimental condition.

80-001662 Daye, P. G. and E. T. Garside. STRUCTURAL ALTERATIONS IN EMBRYOS AND ALEVINS OF THE ATLANTIC SALMON, *SALMO SALAR* L., INDUCED BY CONTINUOUS OR SHORT-TERM EXPOSURE TO ACIDIC LEVELS OF pH. *Can. J. Zool.* 58(1):27-43. Jan. 1980. In English with French summ. SFA 25(2)
[Fish. Mar. Serv., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Embryos of the Atlantic salmon, *Salmo salar* L., were incubated continuously from fertilization, at pH 6.8 (control), 5.0, 4.5, 4.3, 4.0, and 3.7, at 5-6°C. The subsequent alevins in these environments were maintained at these levels for 40 days after hatching. Generally, lethal and sublethal injuries were separable only as to degree and distribution. Sublethal alterations occurred in the integument, gill, blood, and blood vascular structures of all live alevins incubated at pH 5.0 and lower. At pH 4.5 and lower, injuries also occurred in brain, optic retina, kidney, and spleen. Some tissue regeneration occurred in the embryonal rudimentary integument at pH 4.5 and lower. Regeneration also occurred but to a lesser degree in pseudobranch, kidney, spleen, and erythrocytes. Injury of the integument was the apparent cause of death in prehatching embryos since it is the major site of respiration and ion exchange. As gills expand in posthatching alevins, they assume these functions and destruction of branchial epithelium then becomes the prime cause of death. The nature of cell injury and consequent dysgenesis at tissue and organ levels are not ascribable uniquely to acidic stress. Some injuries are similar to those caused variously by heavy metals, detergents, halogenated organic compounds, some petroleum fractions, and chronic and acute high temperature in postalevin stages of several species of fish.

80-001663 Dean, H. J.; J. C. Skea; J. R. Colquhoun and H. A. Simonin. REPRODUCTION OF LAKE TROUT IN LAKE GEORGE. *N.Y. Fish Game J.* 26(2):188-191. July 1979. SFA 25(2)
[State Fish Hatchery, Rome, NY 13440]

80-001664 Dodson, J. J. and C. I. Mayfield. THE DYNAMICS AND BEHAVIORAL TOXICOLOGY OF AQUA-KLEEN® (2,4-D BUTOXYETHANOL ESTER) AS REVEALED BY THE MODIFICATION OF RHEOTROPISM IN RAINBOW TROUT. *Trans. Am. Fish. Soc.* 108(6):632-640. Nov. 1979. SFA 25(2)
[Dep. Biol., Univ. Laval, PQ G1K 7P4, Canada]

80-001665 Eurell, J. A. C. THE EFFECTS OF EXPOSURE TO WATER SOLUBLE FRACTIONS OF CRUDE OIL ON THE HISTOLOGY AND SELECTED HISTOCHEMICAL PARAMETERS OF THE LIVER OF ATLANTIC CROAKER (*MICROPOGON UNDULATUS* L.). *Ph.D.*

TOXICOLOGY; BIOASSAYS

80-001665 CONTINUED *dissertation, Texas A&M Univ.* 147p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(8):3610. Feb. 1980. SFA 25(2)

80-001666 Gilbert, J. P.; J. B. Gratzek and J. Brown. AN *IN VITRO* METHOD FOR TESTING SYNERGISTIC ACTION OF PARASITICIDES USING MALACHITE GREEN AND FORMALIN AS A MODEL SYSTEM. *J. Fish Dis.* 2(3):191-196. May 1979. SFA 25(2)
[Dep. Med. Microbiol., Coll. Vet. Med., Univ. Ga., Athens 30602]

80-001667 Haider, G. HISTOPATHOLOGISCHE VERÄNDERUNGEN AM SEITENLINIENSYSTEM DER REGENBOGENFORELLE (*SALMO GAIRDNERI* RICH.) NACH SUBLETALER SCHWERMETALLVERGIFTUNG. [HISTOPHATOLOGICAL EFFECTS OF SUBLETHAL POISONING BY HEAVY METALS UPON THE LATERAL LINE SYSTEM IN RAINBOW TROUT (*SALMO GAIRDNERI* RICH.)] *Zool. Anz.* 203(5/6):378-391. 1979. In German with English summ. SFA 25(2)
[Univ. Stuttgart, West Germany]

80-001668 Halter, M. T.; W. J. Adams and H. E. Johnson. SELENIUM TOXICITY TO *DAPHNIA MAGNA, HYALLELA AZTECA,* AND THE FATHEAD MINNOW IN HARD WATER. *Bull. Environ. Contam. Toxicol.* 24(1):102-107. Jan. 1980. SFA 25(2)
[Coll. Fish., Univ. Wash., Seattle 98115]

80-001669 Hedtke, J. L. and L. A. Norris. EFFECT OF AMMONIUM CHLORIDE ON PREDATORY CONSUMPTION RATES OF BROOK TROUT (*SALVELINUS FONTINLIS*) ON JUVENILE CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*) IN LABORATORY STREAMS. *Bull. Environ. Contam. Toxicol.* 24(1):81-89. Jan. 1980. SFA 25(2)
[L. A. Norris: For. Sci. Lab., 3200 Jefferson Way, Corvallis, OR 97331]

80-001670 Helfrich, L. A. EFFECTS OF ROTENONE ON MACROBENTHIC INVERTEBRATES OF A PENNSYLVANIA STREAM. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:401-408. 1978[1979]. SFA 25(2)
[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061] Although the use of rotenone as a fish toxicant is a common freshwater fisheries management technique, little is known of its effect on stream invertebrates. In this study pre- and post-treatment bottom samples of benthic invertebrates, collected from 4 study stations, were compared to determine the short-term effects of rotenone. Continuous drift samples collected throughout the treatment period provided additional qualitative information on the vulnerability of the benthic invertebrates to the toxin. Of the 4 major orders of macrobenthic invertebrates represented in Sinking Creek (Trichoptera, Ephemeroptera, Plecoptera, and Diptera), all exhibited substantial decreases in numerical abundance 11 days after rotenone treatment. Populations of Plecoptera (stoneflies) and Diptera (blackflies and midge larvae) were nearly exterminated, while densities of the 2 remaining taxa, Trichoptera (caddisflies) and Ephemeroptera (mayflies) were reduced to 50% of the pretreatment levels. All 4 orders appeared in increased numbers in the drift samples taken during the treatment period.

80-001671 Hemmer, M. J. A PRESSURIZED PROPORTIONAL DILUTER FOR AQUATIC TOXICOLOGICAL STUDIES. *Water Res.* 14(3):243-246. 1980. SFA 25(2)
[U.S. EPA, Gulf Breeze Environ. Res. Lab., Sabine Island, FL 32561] A

TOXICOLOGY; BIOASSAYS

80-001671 CONTINUED half-liter proportional diluter using positive pressure was designed and tested. Its primary siphons are activated by a pulse of pressure instead of by a partial vacuum as in conventional diluters. This method eliminates the need for venturi tubes, vacuum manifolds, and individual water blocks. Pressure can be supplied by air pumps, air cylinders, or air compressor lines. The diluter's advantages are ease of construction, calibration, compact size, and rapid cleaning. Unit cost is approximately $250.00.

80-001672 Hendricks, J. D.; R. O. Sinnhuber; P. M. Loveland; N. E. Pawlowski and J. E. Nixon. HEPATOCARCINOGENICITY OF GLANDLESS COTTONSEEDS AND COTTONSEED OIL TO RAINBOW TROUT *(SALMO GAIRDNERI). Science* 208(4441):309-311. 18 Apr. 1980. SFA 25(2)

[Dep. Food Sci. Technol., Oreg. State Univ., Corvallis 97331] Glandless cottonseed kernels are available for purchase and consumption by the general public. These kernels contain no gossypol but still have a full complement of naturally occurring cyclopropenoid fatty acids, which in rainbow trout are active as synergists with aflatoxins and primary liver carcinogens. Diets containing glandless cottonseed kernels or a lightly processed cottonseed oil produced significant numbers of hepatocellular carcinomas in rainbow trout after 1 year. The much greater incidence of cancer induced by the kernel than by the oil indicates that synergists or other carcinogens may be present in the kernel in addition to the cyclopropenoid fatty acids.

80-001673 Hill, M. W.; J. Hoyland and A. D. Bangham. EFFECTS OF TEMPERATURE AND N-BUTANOL (A MODEL ANAESTHETIC) ON A BEHAIVOURAL FUNCTION OF GOLDFISH. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 135(4):327-332. Feb. 1980. SFA 25(2)

[Biophys. Unit, A.R.C., Inst. Anim. Physiol., Babraham, Cambridge CB2 4AT, England]

80-001674 Hinton, M. J. and A. G. Eversole. TOXICITY OF TEN COMMONLY USED CHEMICALS TO AMERICAN EELS. *Proc. Annu. Conf. Southeast. Assoc. Fish. Wildl. Agencies* 32:599-604. 1978[1979]. SFA 25(2)

[Dep. Entomol. Econ. Zool., Clemson Univ., Clemson, SC 29631] Malachite green, potassium permanganate, salt, formalin, Dylox, Furanace, antimycin A, Noxfish, copper sulfate, and Diquat were tested to determine 96-hour LC_{50} values for the glass eel stage of the American eel, *Anguilla rostrata* (Lesueur). Static acute toxicity tests were conducted at 22 C using deionized water reconstituted to a hardness of 40-48 mg/l, an alkalinity of 30-35 mg/l and a pH of 7.2-7.6. The calculated 96-hour LC_{50} values for the chemicals are: malachite green 0.27 mg/l; potassium permanganate 3.06 mg/l; salt 17.88 g/l; formalin 83.96 mg/l; Dylox 1.31 mg/l; Furanace 0.77 mg/l; antimycin A 0.09 µg/l; Noxfish 15.25 µg/l; copper sulfate 2.54 mg/l; and Diquat 39.02 mg/l.

80-001675 Hoke, R. A. and B. L. Prater. THE RELATIONSHIP OF % MORTALITY OF FOUR SPECIES OF AQUATIC BIOTA FROM 96-HOUR SEDIMENT BIOASSAYS OF FIVE LAKE MICHIGAN HARBORS AND ELUTRIATE CHEMISTRY OF THE SEDIMENTS. *Ohio J. Sci.* 80:95. 1980. Abstract only. SFA 25(2)

[Dep. Biol. Sci., Bowling Green State Univ., Bowling Green, OH 43403] During the summer and fall of 1977, sediment grab samples were collected from forty stations in five Lake Michigan harbors using a Standard Ponar dredge. Samples were split and a portion used as the substrate for 96-hour sediment bioassays using *Pimephales promelas, Hexagenia limbata, Lirceus*

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80-001675 CONTINUED *fontinalis*, and *Daphnia magna*. The remaining portion of each sample was analyzed for fifteen elutriate chemistry parameters. Elutriate chemistry data and % mortality data of the four test species were bivariately correlated. Of the sixty total correlations performed, four were significant (N=40, $r \geq 0.40$, $p \leq 0.05$). Release of chloride correlated with % mortality of *P. promelas* (r=0.59) and *H. limbata* (r=0.40). Percent mortality of *H. limbata* also correlated with release of ammonia (r=0.44) and nickel (r=0.72) during the elutriate test. The relationship of chloride release and % mortality of *P. promelas* may indicate a threshold effect occurs at 41 mg/l release of chloride. Ammonia and nickel have been previously reported as toxic to aquatic biota. The present investigation indicates that a linear relationship accounts for ≅ 50% of the variance in the relationship between nickel release from the sediments and % mortality of *H. limbata*.

80-001676 Holman, W. F. and K. J. Macek. AN AQUATIC SAFETY ASSESSMENT OF LINEAR ALKYLBENZENE SULFONATE (LAS): CHRONIC EFFECTS ON FATHEAD MINNOWS. *Trans. Am. Fish. Soc.* 109(1):122-131. Jan. 1980. SFA 25(2)
[Environ. Safety Dep., Proctor & Gamble Co., Ivorydale Tech. Cent., Cincinnati, OH 45217]

80-001677 Ilan, Z. and Z. Yaron. EFFECTS OF ORGANOCHLORINES ON INTERRENAL ACTIVITY AND CORTISOL METABOLISM IN *TILAPIA AUREA*. *Gen. Comp. Endocrinol.* 40(3):345. Mar. 1980. Abstract only. SFA 25(2)
[Dep. Zool., Tel Aviv Univ., Tel Aviv, Israel]

80-001678 Karpovich, T. A. and B. I. Kolupayev. AN ELECTROMYOGRAM OF THE MANDIBULAR ADDUCTOR OF THE INTACT BAIKAL GRAYLING, *THYMALLUS ARCTICUS BAICALENSIS*, IN A PHENOL SOLUTION. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):866-869. 1978. SFA 25(2)
[Dep. Ecol. Toxicol., All-Union Cellulose Paper Ind. Sci. Prod. Combine, Baikal'sk, USSR]

80-001679 Kiceniuk, J. W.; G. L. Fletcher and R. Misra. PHYSIOLOGICAL AND MORPHOLOGICAL CHANGES IN A COLD TORPID MARINE FISH UPON ACUTE EXPOSURE TO PETROLEUM. *Bull. Environ. Contam. Toxicol.* 24(2):313-319. Feb. 1980. SFA 25(2)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

80-001680 Kobayashi, K. and N. Nakamura. MAJOR DETOXIFICAITON PATHWAYS FOR PENTACHLOROPHENOL IN GOLDFISH. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1185-1188. Sept. 1979. SFA 25(2)
[Lab. Fish. Chem., Fac. Agric., Kyushu Univ., Fukuoka 812, Japan]

80-001681 Koundinya, P. R. and R. Ramamurthi. EFFECT OF ORGANOPHOSPHATE PESTICIDE SUMITHION (FENITROTHION) ON SOME ASPECTS OF CARBOHYDRATE METABOLISM IN A FRESHWATER FISH, *SAROTHERODON (TILAPIA) MOSSAMBICUS* (PETERS). *Experientia (Basel)* 35(12):1632-1633. Dec. 1979. SFA 25(2)
[Dep. Zool., Sri Venkateswara Univ. Coll., Tirupati, India] A lethal (LC_{50}/48 h - 6 mg/l) concentration of the organophosphate (OP)

TOXICOLOGY; BIOASSAYS

80-001681 CONTINUED pesticide Sumithion increased blood glucose levels and phosphorylase activity, but hepatic glycogen registered a fall which indicated that the observed hyperglycemia was due to breakdown of hepatic glycogen.

80-001682 Kumada, H.; S. Kimura and M. Yokote. ACCUMULATION AND BIOLOGICAL EFFECTS OF CADMIUM IN RAINBOW TROUT. *Bull. Jpn. Soc. Sci. Fish.* 46(1):97-103. Jan. 1980. SFA 25(2)

[Arasaki Mar. Biol. Stn., Nagai, Yokosuka-shi, Kanagawa-ken 238-03, Japan] Biological effects and accumulation of cadmium stearate, acetate, and chloride in rainbow trout fingerlings were investigated. No adverse effect was observed on survival, growth and histology of the fish exposed to cadmium compounds via water at a concentration of 4 µgCd/l for 10 weeks, and also the fish exposed to the same compounds via food at a concentration of 10 mgCd/kg for 12 weeks. However, the fish orally exposed to cadmium stearate of 100 mgCd/kg showed histological changes of a slight degree in their livers and kidneys. Total cadmium loads (µgCd/fish) prominently decreased in the fish orally exposed to the chemicals 10 weeks after discontinuation of exposure, while those in the exposed fish via ambient water almost remained unchanged during this time. Translocation of cadmium in the tissue showed different pattern with route of absorption after withdrawal of exposure. From the results of the present study, it is postulated that the route of cadmium absorption via water chiefly may participate in the accumulation of the metal in fishes under the natural condition.

80-001683 Leatherland, J. F. and R. A. Sonstegard. EFFECT OF DIETARY MIREX AND PCB (AROCLOR 1254) ON THYROID ACTIVITY AND LIPID RESERVES IN RAINBOW TROUT *SALMO GAIRDNERI* RICHARDSON. *J. Fish. Dis.* 2(1):43-48. Jan. 1979. SFA 25(2)

[Dep. Zool., Univ. Guelph, Guelph, ON, Canada] Rainbow trout were fed diets contaminated with either PCB (Aroclor 1254, 500 µg/g dry food) or Mirex (500 µg/g dry food). There was no apparent effect of PCB on thyroid histology or on serum thyroid hormone levels. Mirex effected significant reductions in serum T_4 ($P<0.05$) and T_3 levels ($P<0.01$) without apparent change in the histological appearance of the thyroid. Liver weights and total liver lipid content were significantly ($P<0.001$) greater in PCB-fed fish compared with controls as was the carcass lipid content ($P<0.01$). Mirex had no apparent effect on liver size or liver lipid content but there was a decline in carcass lipid content ($P<0.02$) which persisted 25 days after returning Mirex-fed fish to the control diet ($P<0.05$).

80-001684 Lehtinen, K-J. EFFECTS ON FISH EXPOSED TO EFFLUENT FROM A TITANIUM DIOXIDE INDUSTRY AND TESTED WITH ROTATORY-FLOW TECHNIQUE. *Ambio* 9(1):31-33. 1980. SFA 25(2)

[Swedish Water Air Pollut. Res. Inst., S-611 82 Nyköping, Sweden]

80-001685 Miyauchi, M.; M. Takagi and T. Uematsu. STUDIES ON TOXICITIES OF BIPHENYL ETHER HERBICIDES AND THEIR ANALOGUES TO FISH--I. THE METHEMOGLOBIN-FORMATION BY THE NITROSO-DERIVATIVES IN WHITE-SPOTTED CHAR, *SALVELINUS LEUCOMAENIS* ERYTHROCYTES. *Bull. Jpn. Soc. Sci. Fish.* 45(12):1563-1567. Dec. 1979. SFA 25(2)

[Lab. Food Hygiene, Fac. Fish., Hokkaido Univ., Hakodate 041, Japan] The methemoglobin formation by the nitroso-derivatives of biphenyl ether herbicides (2,4-dichloro *p*-nitrobiphenyl ether and 2,4,6-trichloro *p*-nitrobiphenyl ether) and their analogues was investigated in

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80-001685 CONTINUED suspensions of white-spotted char erythrocytes. All of the nitroso-derivatives used, induced the methemoglobin formation in white-spotted char erythrocytes as well as human erythrocytes and the activity of methemoglobin formation among the nitroso-derivatives was the most potent in nitrosobenzene followed by *p*-nitrosobiphenyl ether, 4-chloro *p*-nitrosobiphenyl ether, 2,4-dichloro *p*-nitrosobiphenyl ether and then 2,4,6-trichloro *p*-nitrosobiphenyl either in erythrocytes in both species. This order among the nitroso-derivatives was dependent on the number of chlorine rather than on its position of substitution in the phenoxy group.The mechanism of methemoglobin formation by the nitroso-derivatives was similar in erythrocytes of both species and on the requirement of NADPH-dependent enzyme systems, and that of methemoglobin reduction was similar, too, on reception of NADH-dependent enzymatic process.

80-001686 Miyauchi, M.; M. Takagi and T. Uematsu. STUDIES ON TOXICITIES OF BIPHENYL ETHER HERBICIDES AND THEIR ANALOGUES TO FISH--II. PRODUCTION OF METHEMOGLOBIN-FORMING METABOLITES OF THE AMINO-DERIVATIVES BY WHITE-SPOTTED CHAR, *SALVELINUS LEUCOMAENIS*, LIVER HOMOGENATE. *Bull. Jpn. Soc. Sci. Fish.* 45(12):1569-1573. Dec. 1979. SFA 25(2)

[Lab. Food Hygiene, Fac. Fish., Hokkaido Univ., Hakodate 041, Japan] The activities of liver homogenates from white-spotted char and rat, to metabolize the amino-derivatives of biphenyl ether herbicides (2,4-dichloro *p*-nitrobiphenyl ether and 2,4,6-trichloro *p*-nitrobiphenyl ether) and their analogues to methemoglobin-forming metabolites were compared by incubating liver homogenates with the amino-derivatives, a NADPH-generating system and white-spotted char, rat or human erythrocytes. The results indicated that white-spotted char liver homogenates had the ability to metabolize *p*-aminobiphenyl ether to methemoglobin-forming metabolites although the activity was very low; white rat liver homogenates had the ability to metabolize all the amino-derivatives to methemoglobin-forming metabolites and the rates of methemoglobin formation among the amino-derivatives were the highest in *p*-aminobiphenyl ether followed by 4-chloro *p*-aminobiphenyl ether, 2,4-dichloro *p*-aminobiphenyl ether and then 2,4,6-trichloro *p*-aminobiphenyl ether. The sensitivity of erythrocytes to the methemoglobin-forming metabolites were the highest in human followed by rat and then white-spotted char erythrocytes.

80-001687 Muntyan, S. P. SOME OBSERVATIONS ON THE REPRODUCTION AND EMBRYONIC DEVELOPMENT OF FIVE SPECIES OF FISH KEPT IN EXPERIMENTAL RADIACTIVE WATER BODIES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1033-1038. 1978. SFA 25(2)

[IEMEZh, USSR Acad. Sci., Moscow, USSR] The experiments show a very high rate of survival of eggs taken from the spawning grounds of the perch and roach inhabiting a body of water with increased radioactivity. The slightly lower rate of survival of the eggs of the pike and of the crucian carp and common wild goldfish obtained by artificial fertilization is evidently above all connected with the imperfection of the method of obtaining the eggs from these fish and the unfavorable influence of the incubation temperature and gas regimes. Nonetheless, for these fish too the number of normal embryos at the end of incubation is considerable. The results of the experiments are similar to those of the incubation of eggs of the species mentioned without the action of the radioactive factor; they show that the maturation of sexual products, spawning and normal development of the embryos of these species under the conditions of the current levels of radioactivity is practicable. This conclusion is also confirmed by the fact that in the bodies of water investigated there have been several generations of fish since the time that radionuclides were introduced into them.--From text.

TOXICOLOGY; BIOASSAYS

80-001688 Nagel, R. and K. Urich. KINETIC STUDIES ON THE ELIMINATION OF DIFFERENT SUBSTITUTED PHENOLS BY GOLDFISH (*CARASSIUS AURATUS*). *Bull. Environ. Contam. Toxicol.* 24(3):374-378. Mar. 1980. SFA 25(2)
[Dep. Zool., Johannes-Gutenberg-Univ., Mainz, Saarstrasse 21, D-6500 Mainz, West Germany]

80-001689 Neville, C. M. INFLUENCE OF MILD HYPERCAPNIA ON THE EFFECTS OF ENVIRONMENTAL ACIDIFICATION ON RAINBOW TROUT (*SALMO GAIRDNERI*). *J. Exp. Biol.* 83:345-349. Dec. 1979. SFA 25(2)
[Dep. Zool., Univ. Toronto, Toronto, ON, Canada]

80-001690 Ozoh, P. T. E. EFFECTS OF REVERSIBLE INCUBATIONS OF ZEBRAFISH EGGS IN COPPER AND LEAD IONS WITH OR WITHOUT SHELL MEMBRANES. *Bull. Environ. Contam. Toxicol.* 24(2):270-275. Feb. 1980. SFA 25(2)
[P.O. Box 3418, Onitscha, Anambra State, Nigeria]

80-001691 Ozoh, P. T. E. EFFECT OF LEAD ON PIGMENT PATTERN FORMATION IN ZEBRAFISH (*BRACHYDANIO RERIO*). *Bull. Environ. Contam. Toxicol.* 24(2):276-282. Feb. 1980. SFA 25(2)
[P.O. Box 3418, Onitscha, Anambra State, Nigeria]

80-001692 Passino, D. R. M. and J. M. Kramer. TOXICITY OF ARSENIC AND PCBs TO FRY OF DEEPWATER CISCOES (*COREGONUS*). *Bull. Environ. Contam. Toxicol.* 24(4):527-534. Apr. 1980. SFA 25(2)
[U.S. FWS, Great Lakes Fish. Lab., Ann Arbor, MI 48105]

80-001693 Pechkurenkov, V. L. and G. L. Pokrovskaya. ON THE CORRESPONDENCE OF DATA ON THE INCUBATION OF FISH EGGS IN SOLUTIONS OF STRONTIUM-90 -- YTTRIUM-90 OF VARYING ACTIVITY UNDER LABORATORY CONDITIONS AND IN NATURAL WATERS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):995-1004. 1978. SFA 25(2)
[All-Union Res. Inst. Pond Fish., USSR Acad. Sci., USSR]

80-001694 Pfeifer, K. F. and L. J. Weber. THE EFFECT OF CARBON TETRACHLORIDE TREATMENT ON URINE FLOW RATE OF THE RAINBOW TROUT, *SALMO GAIRDNERI*. *Toxicol. Appl. Pharmacol.* 52(2):347-350. Feb. 1980. SFA 25(2)
[Allied Chemical Corp., Morristown, NJ 07960]

80-001695 Pittinger, C. A. and D. S. Tennant. CRITICAL SURFACE TENSION OF SODIUM LAURAL SULFATE TO THE FATHEAD MINNOW, *PIMEPHALES PROMELAS*. *J. Tenn. Acad. Sci.* 55(2):54. Apr. 1980. Abstract only. SFA 25(2)

80-001696 Redner, B. D.; J. R. Tomasso and B. A. Simco. SHORT TERM ALLEVIATION OF AMMONIA TOXICITY BY ENVIRONMENTAL SODIUM CHLORIDE IN CHANNEL CATFISH (*ICTALURUS PUNCTATUS*). *J. Tenn. Acad. Sci.* 55(2):54. Apr. 1980. Abstract only. SFA 25(2)
[Memphis State Univ., Memphis, TN] Plasma sodium depletion has been suggested as a contributing mechanism of ammonia toxicity in aquatic animals. The addition of sodium chloride to water has long been recognized as a method for preventing plasma electrolyte depletion in fish. This study was designed to determine the effect of environmental sodium chloride on ammonia toxicity to channel catfish (*Ictalurus punctatus*). The 6, 12 and 24 hour median lethal concentrations (LC50) of total ammonia nitrogen in fresh water (pH=6.9-7.1, total hardness=47 mg/liter, temperature=20-24°C) were

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80-001696 CONTINUED significantly lower (305.5±21.9, 255.2±10.3, 269.9±9.2 mg/liter ±S.E., respectively) than in isonatremic (8.3 g/liter NaCl) water (832.9±16.5, 367.7±16.8, 337.7±13.2 mg/liter ±S.E., respectively). However, the 48 hour LC50 values were not different (287.7±5.9 versus 256.9±3.4 mg/liter), indicating that environmental sodium chloride has only a short term protective effect. This effect is probably due to prevention of plasma sodium depletion. The absence of a long term protective effect by sodium chloride indicates the presence of other mechanisms of ammonia toxicity.

80-001697 Sastry, K. V. and P. K. Gupta. CHANGES IN THE ACTIVITIES OF SOME DIGESTIVE ENZYMES OF *CHANNA PUNCTATUS*, EXPOSED CHRONICALLY TO MERCURIC CHLORIDE. *J. Environ. Sci. Health B Pestic. Food Contam. Agric. Wastes (Marcel Dekker, Inc., N.Y.)* 15(1):109-119. 1980. SFA 25(2)
[Sch. Environ. Contam. Toxicol., Dep. Zool., D. A. V. (P.G.) Coll., Muzaffarnagar, India]

80-001698 Sastry, K. V. and K. Sharma. DIAZINON EFFECT ON THE ACTIVITIES OF BRAIN ENZYMES FROM *OPHIOCEPHALUS (CHANNA) PUNCTATUS*. *Bull. Environ. Contam. Toxicol.* 24(3):326-332. Mar. 1980. SFA 25(2)
[Sch. Environ. Contam. Toxicol., Dep. Zool., D.A.V. (P.G.) Coll., Muzaffarnagar, India]

80-001699 Schubauer, J. P.; C. L. Scott; K. T. Kowalski and J. R. Spotila. EFFECT OF TETRACYCLINE HYDROCHLORIDE TREATMENT ON THE CRITICAL THERMAL MAXIMUM OF COMMON SHINERS. *Prog. Fish-Cult.* 42(1):48-49. Jan. 1980. SFA 25(2)
[Savannah River Ecol. Lab., Drawer E, Aiken, SC 29801]

80-001700 Skadsen, J. M.; P. W. Webb and P. T. Kostecki. MEASUREMENT OF SUBLETHAL METABOLIC STRESS IN RAINBOW TROUT (*SALMO GAIRDNERI*) USING AUTOMATED RESPIROMETRY. *J. Environ. Sci. Health B Pestic. Food Contam. Agric. Wastes (Marcel Dekker, Inc., N.Y.)* 15(2):193-206. 1980. SFA 25(2)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109] Sublethal effects of rotenone on the metabolic rates of rainbow trout (*Salmo gairdneri* Richardson) were determined. Metabolic measurements were made by the method of increasing velocity steps, using a miniature version of the Blazka respirometer with automatic dissolved oxygen measurement. Regressions of log metabolic rate versus swimming speed (expressed as relative performance) were compared for the toxicant levels tested. Results were interpreted in terms of Fry's classification of environmental factors using metabolic response categories ("Fry's paradigm"). At high rotenone dosages (96 hr. LC 50), reduction in the critical swimming speed and the active metabolic rate (limiting effect) were observed. At lower toxicant levels (0.20 x 96 hr. LC 50) the standard metabolic rate was elevated (masking effect) and the limiting effect disappeared. The elevation in metabolic rate decreased in competition with locomotor energy costs as they increased with swimming speed (modulated masking effect).

80-001701 Smit, G. L.; J. Hattingh and A. P. Burger. HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS 222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: INTRASPECIES DIFFERENCES.

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80-001701 CONTINUED *J. Fish Biol.* 15(6):645-653. Dec. 1979. SFA 25(2)
[Dep. Zool., Rand Afrikaans Univ., P.O. Box 524, Johannesburg 2000, South Africa] The effects of different concentrations of natural MS 222 and neutralized MS 222 were studied on the haematology of *Cyprinus carpio*, *Sarotherodon mossambicus* and *Salmo gairdneri*. As judged from the results, MS 222, which is acidic in nature, produced haemo-concentration effects in all species studied, being least in the trout followed by carp and *Sarotherodon mossambicus*. These differences are ascribed to acid-base regulatory functions and metabolic activities of the fish species investigated. The use of neutralized MS 222 improved the haematological profiles markedly and resulted in stabilization of acid-base parameters and red blood cells sizes and numbers. Haemoconcentration effects, however, still persisted. Trout were found to be more susceptible to the stress of MS 222 anaethesia than carp and *Sarotherodon mossambicus*.

80-001702 Smit, G. L.; J. Hattingh and A. P. Burger. HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS 222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: INTERSPECIES DIFFERENCES. *J. Fish Biol.* 15(6):633-643. Dec. 1979. SFA 25(2)
[Dep. Zool., Rand Afrikaans Univ., P.O. Box 524, Johannesburg 2000, South Africa] Interspecies haematological differences to MS 222 and neutralized MS 222 anaesthesia were investigated in *Sarotherodon mossambicus*. *Cyprinus carpio* and *Salmo gairdneri* acclimated under identical laboratory conditions. Anaethesia with MS 222 resulted in a 'chemical stress' in all fish, as was evident from change in the haematological profiles of the animals. Such species specific variations in the haematology persisted throughout the whole experiment protocol which employed different concentrations of the anaesthetic. The use of netralized MS 222, whereby aquarium water quality remained unchanged, improved the haematological profile. Possible reasons for the interspecies differences observed are discussed.

80-001703 Smit, G. L.; J. Hattingh and A. P. Burger. HAEMATOLOGICAL ASSESSMENT OF THE EFFECTS OF THE ANAESTHETIC MS 222 IN NATURAL AND NEUTRALIZED FORM IN THREE FRESHWATER FISH SPECIES: HAEMOGLOBIN ELECTROPHORESIS, ATP LEVELS AND CORPUSCULAR FRAGILITY CURVES. *J. Fish Biol.* 15(6):655-663. Dec. 1979. SFA 25(2)
[Dep. Zool., Rand Afrikaans Univ., P.O. Box 524, Johannesburg 2000, South Africa] The effects of MS 222 and neutralized MS 222 anaethesia on haemoglobin electrophoresis, erythrocyte adenosine triphosphate (ATP) levels and corpuscular fragility curves were studied in *Cyprinus carpio*, *Sarotherodon mossambicus* and *Salmo gairdneri*. Haemoglobin electrophoresis showed no significant intra-species differences in the percentage composition of the various fractions for any concentration of MS 222 and neutralized MS 222 used. Significant interspecies differences were, however, still observed. ATP levels showed intra- and interspecies differences ascribed to the response of the fish species to MS 222-induced stress and not to actual change in erythrocyte ATP concentrations. Differences were also observed in corpuscular fragility curves for all three species when using MS 222 or neutralized MS 222 compared to curves obtained without the use of the anesthetic, but the mechanisms involved are not clear.

80-001704 Spehar, R. L.; J. T. Fiandt; R. L. Anderson and D. L. DeFoe. COMPARATIVE TOXICITY OF ARSENIC COMPOUNDS AND THEIR ACCUMULATION IN INVERTEBRATES AND FISH. *Arch. Environ. Contam. Toxicol.* 9(1):53-63. 1980.

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80-001704 CONTINUED SFA 25(2)
[U.S. EPA, 6201 Congdon Blvd., Duluth, MN 55804]

80-001705 Sudershan, P. and M. A. Q. Khan. METABOLIC AND ELIMINATION PRODUCTS OF [^{14}C]PHOTODIELDRIN FROM BLUEGILL FISH. *Pestic. Biochem. Physiol.* 12(3):216-223. Dec. 1979. SFA 25(2)
[Dep. Biol. Sci., Univ. Ill., Box 4348, Chicago 60680]

80-001706 Sugatt, R. H. EFFECTS OF SODIUM DICHROMATE EXPOSURE ON THE IMMUNE RESPONSES OF JUVENILE COHO SALMON, *ONCORHYNCHUS KISUTCH*, AGAINST *VIBRIO ANGUILLARUM*. *Arch. Environ. Contam. Toxicol.* 9(2):207-216. 1980. SFA 25(2)
[Life Sci. Div., Syracuse Research Corp., Syracuse, NY 13210]

80-001707 Sugatt, R. H. EFFECTS OF SUBLETHAL SODIUM DICHROMATE EXPOSURE IN FRESHWATER ON THE SALINITY TOLERANCE AND SERUM OSMOLALITY OF JUVENILE COHO SALMON, *ONCORHYNCHUS KISUTCH*, IN SEAWATER. *Arch. Environ. Contam. Toxicol.* 9(1):41-52. 1980. SFA 25(2)
[Life Sci. Div., Syracuse Res. Corp., Syracuse, NY 13210]

80-001708 Tomasso, J. R.; C. A. Goudie; B. A. Simco and K. B. Davis. EFFECTS OF ENVIRONMENTAL pH AND CALCIUM ON AMMONIA TOXICITY IN CHANNEL CATFISH. *Trans. Am. Fish. Soc.* 109(2):229-234. Mar. 1980. SFA 25(2)
[Ecol. Res. Cent., Dep. Biol., Memphis State Univ., Memphis TN 38152]

80-001709 Tsai, C. and J. A. McKee. ACUTE TOXICITY TO GOLDFISH OF MIXTURES OF CHLORAMINES, COPPER, AND LINEAR ALKYLATE SULFONATE. *Trans. Am. Fish. Soc.* 109(1):132-141. Jan. 1980. SFA 25(2)
[Chesapeake Biol. Lab., Cent. Environ. Estuarine Stud., Univ. Md., Solomons 20688]

80-001710 Vrochinskiy, K. K. and G. V. Zemkov. PHYSIOLOGICAL-BIOCHEMICAL DATA ON EXPERIMENTAL INTOXICATION OF FISH WITH "YALAN". *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):1004-1009. 1978. SFA 25(2)
[KaspNIIRKh, Astrakhan, USSR] The limits of the toxicity of the herbicide "yalan" for 8 day old larvae of the carp, *Cyprinus carpio* were established. At the moment of intoxication the motor activity is decreased in second year carp with simultaneous increase in the amount of ammonia, urea and hydroperoxides of the lipids in the dorsal white muscle. The amount of glucose in the blood is simultaneously reduced.

80-001711 Yockim, R. S.; A. R. Isensee and E. A. Walker. BEHAVIOR OF TRIFLURALIN IN AQUATIC MODEL ECOSYSTEMS. *Bull. Environ. Contam. Toxicol.* 24(1):134-141. Jan. 1980. SFA 25(2)
[Pestic. Degradation Lab., USDA, Beltsville, MD 20705]

FISH TOXICANTS

80-001712 Orciari, R. D. ROTENONE RESISTANCE OF GOLDEN SHINERS FROM A PERIODICALLY RECLAIMED POND. *Trans. Am. Fish. Soc.* 108(6):641-645. Nov. 1979. SFA 25(2)
[Conn. Dep. Environ. Prot., Middlebury 06762]

RESEARCH AND MANAGEMENT-GENERAL

80-001713 Haussler, R. B. CALIFORNIA'S FRESHWATER ENVIRONMENTAL PROBLEMS. *Cal-Neva Wildl.* 1979:45-54. 1979. SFA 25(2)
[Calif. Energy Comm., Environ. Eng. Div., Sacramento] Limited water resources in California have resulted in intense competition for available supplies. Environmental and institutional constraints presently limit the potential for siting thermal electric power plants near coastal waters of California. Consequently, the search for viable sites has moved inland, away from the coast, where the utility companies must compete with various interests such as agriculture, for water supplies necessary for cooling purposes. A power plant siting proposal before the Energy Commission serves as an example of the varied considerations which must be made as a result of the current dilemma.

80-001714 Melteff, B. R., ed. ALASKA FISHERIES: 200 YEARS AND 200 MILES OF CHANGE. *Proc. Alaska Sci. Conf.* 29:1-796. Aug. 1979. SFA 25(2)
A collection of papers.--RS

80-001715 Peterman, R. M. DYNAMICS OF NATIVE INDIAN FOOD FISHERIES ON SALMON IN BRITISH COLUMBIA. *Can. J. Fish. Aquatic Sci.* 37(4):561-566. Apr. 1980. SFA 25(2)
[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada]

80-001716 Saunders, R. L. THE STOCK CONCEPT - A MAJOR CONSIDERATION IN SALMON RESTORATION. *N. Am. Salmon Res. Cent. Rep.* No. 3. 6p. 1979. SFA 25(2)
[Huntsman Mar. Lab., St. Andrews, NB E0G 2X0, Canada]

80-001717 Shupp, B. D. 1978 STATUS OF BASS FISHING TOURNAMENTS IN THE UNITED STATES. *Fisheries (Bull. Am. Fish. Soc.)* 4(6):11-18. Nov.-Dec. 1979. SFA 25(2)
[Box 278, Chestertown, NY 12817]

80-001718 Temple, R. WARM-WATER FISH MANAGEMENT IN OREGON. *Oreg. Wildl.* 35(2):3-7. Feb. 1980. SFA 25(2)
[Oreg. Div. Wildl., Portland 97208]

ADMINISTRATION AND PLANNING

80-001719 Platts, W. S. A PLEA FOR FISHERY HABITAT CLASSIFICATION. *Fisheries (Bull. Am. Fish. Soc.)* 5(1):2-6. Jan.-Feb. 1980. SFA 25(2)
[U.S. For. Serv. Range Exp. Stn., Boise, ID] Fishery biologists do not have a workable system for classifying the fishery habitat. As a result, our work in land use planning and management has been difficult. This article describes why a classification is needed, what the classification should be composed of, and what it will accomplish. The author requests that the American Fishery Society be the guiding organization in the development of fishery habitat classification.

ADMINISTRATION AND PLANNING

80-001720 Platts, W. S. INCLUDING THE FISHERY SYSTEM IN LAND PLANNING. *U.S. For. Serv. Intermountain For. Range Exp. Stn. Gen. Tech. Rep.* GTR-INT-60. 1979. SFA 25(2)

[U.S. For. Serv., Intermountain For. Range Exp. Stn., 316 E. Myrtle St., Boise, ID 83706] The USDA Forest Service uses a geomorphic analysis that classifies units of land in its Land Systems Inventory. This inventory provides managers with a description of the geology, geomorphic processes, and watershed conditions within any given area of land. Similar areas of land can then be identified, classified, and mapped. The inventory information is then used to determine the type and intensity of land uses each of these stratified land areas can provide and still protect the environment and allows land managers to intelligently plan for future land uses. Although the system provides some protection for the aquatic environment, the inventory, built on terrestrial descriptions, does not provide the information needed for managing aquatic resources. Through the study reported here, a system was developed to integrate all streams and their fisheries into the Land Systems Inventory at the landtype association level and to include most streams and their fisheries at the landtype level of planning. This integration was possible because similar lands in the natural state also have similar streams and fisheries. Similar lands have similar fisheries because watersheds influence the development of the abiotic and biotic components of the stream. The abiotic components of the stream dictated fish biomass and species composition. Therefore, fish biomass and species composition can be determined at levels of accuracy needed in land use planning by using the Land Systems Inventory that identifies similar lands. Thus for the first time the land-manager has a planning system covering large areas that includes both the terrestrial and aquatic environments in the final allocation of resources.

REPORTS OF FISHERY STATIONS, STATES, ETC.

80-001721 Foyle Fisheries Commission. REPORT FOR THE YEAR ENDED DECEMBER 31ST 1978. *Foyle Fish. Comm. Annu. Rep.* 27:1-61. 31 Mar. 1979. SFA 25(2)

[Belfast, Northern Ireland]

HABITAT ALTERATIONS

80-001722 Baxter, R. M. and P. Glaude. ENVIRONMENTAL EFFECTS OF DAMS AND IMPOUNDMENTS IN CANADA. EXPERIENCE AND PROSPECTS. *Can. Bull. Fish. Aquatic Sci.* 205. vi + 34p. 1980. SFA 25(2)

[Dep. Environ., Natl. Water Res. Inst., Burlington, ON L7R 4A6, Canada] Although dams and reservoirs have contributed immeasurably to the well-being of Canadians they may have side effects which may be detrimental to the environment and to human welfare. In this Bulletin, the authors survey the environmental consequences that have ensued from dam construction and the impoundment of water in Canada in the past, and attempt to alert environmentalists and engineers to the types of problems that may be associated with such activities in the future. Some of these effects are immediate, direct, and obvious, such as the loss of resources by flooding, interference with the passage of fish, and environmental damage and pollution as a result of construction activities. Others may manifest themselves only over a period of time, such as changes in water chemistry and modification of the new shoreline. This last is likely to be of particular importance in reservoirs on permafrost. Large impoundments may influence the climate in their vicinities and sometimes induce earthquakes. Still other consequences follow from the mode of operation of the reservoir. Low-level discharge through turbines may radically alter the temperature regime in the stream below. The induction of an unnatural seasonal pattern of water level

HABITAT ALTERATIONS

80-001722 CONTINUED fluctuation may lead to the formation of a virtually barren drawdown zone around the reservoir, and induce geographical and ecological changes downstream, sometimes at great distances. Many of these effects act in various and sometimes opposing ways on the living organisms in the reservoir and the stream so that the ultimate biological consequences often cannot be confidently predicted. It is sometimes difficult to reconcile the interests of those who stand to benefit from a given project and the interests of others who are likely to suffer a loss from it. This conflict is particularly acute when the project affects communities of native peoples following a traditional way of life. Such fragile societies are likely to be gravely disrupted unless particular care is taken.

80-001723 Bella, D. A. and K. J. Williamson. DIAGNOSIS OF CHRONIC IMPACTS OF ESTUARINE DREDGING. *J. Environ. Syst.* 9(4):289-311. 1979-80. SFA 25(2)
[Dep. Civ. Eng., Oreg. State Univ., Corvallis 97330] A method for identifying environmental impacts to estuarine sediments has been developed and applied to Coos Bay, Oregon. This approach is directed towards early phases of environmetal impact assessment and appears to be effective for promoting truly interdisciplinary efforts. Physical, chemical and biological characteristics are sketched on a two-dimensional plot of organic content of the sediment (OCS) versus rate of sediment turnover (RST). These plots are overlayed to given common characteristics. Movements of stations on the plane are identified as chronic impacts.

80-001724 Belt, G. H. PREDICTING STREAMFLOW CHANGES CAUSED BY FOREST PRACTICES USING THE EQUIVALENT CLEARCUT AREA MODEL. *Univ. Idaho For. Range Wildl. Exp. Stn. Bull.* No. 32. 11p. Jan. 1980. SFA 25(2)
[Coll. For., Univ. Idaho, Moscow 83843]

80-001725 Dudley, R. G. and K. N. Black. DISTRIBUTION OF STRIPED BASS EGGS AND LARVAE IN THE SAVANNAH RIVER ESTUARY. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:561-570. 1978[1979]. SFA 25(2)
[Sch. For. Resour., Univ. Ga., Athens 30602] A tide gate on the Savannah Back River, constructed by U.S. Army Corps of Engineers, might decrease survival of the striped bass (*Morone saxatilis*) eggs and larvae spawned near Savannah, Georgia. An initial season of sampling, with the tide gate held open, yielded striped bass eggs and larvae both up- and downstream from the gate. The distribution of eggs and larvae under normal conditions was established. Maximum numbers of striped bass eggs did not reveal $2/m^3$. Spawning occurred at temperatures between 17 and 23 C but 3 spawning peaks coincided with temperatures between 19.5 and 21 C. Slightly more eggs were found farther upstream during the last spawning peak. All stations sampled yielded eggs or larvae at some time, but stations in Back River generally produced the most eggs. Significant numbers of eggs were found in sections of the river flanked by industry but many of these eggs orignated in other areas of the river. Because it alters river flow patterns, the tide gate: 1) may incrase the likelihood that striped bass eggs and larvae will move into polluted sections of the river, 2) may incrase the distance which striped bass eggs and larvae are transported downstream, and 3) will increase the likelihood that eggs will encounter waters of higher salinities.

80-001726 Dugas, R.; V. Guillory and M. Fischer. OIL RIGS AND OFFSHORE SPORT FISHING IN LOUISIANA. *Fisheries (Bull. Am. Fish. Soc.)* 4(6):2-8, 10. Nov.-Dec. 1979. SFA 25(2)

HABITAT ALTERATIONS

80-001727 Galvin, M. MANAGEMENT OF TRANSMISSION LINE RIGHTS-OF-WAY FOR FISH AND WILDLIFE. *U.S. Fish Wildl. Serv.* FWS/OBS-79/22. 1979. SFA 25(2)
[Asplundh Environ. Serv., Blair Mill Rd., Willow Grove, PA 19090]

80-001728 Gregg, R. E. and E. P. Bergersen. *MYSIS RELICTA*: EFFECTS OF TURBIDITY AND TURBULENCE ON SHORT-TERM SURVIVAL. *Trans. Am. Fish. Soc.* 109(2):207-212. Mar. 1980. SFA 25(2)
[Off. Surface Mining, 1823 Stout St., Denver, CO 80210]

80-001729 Gurtz, M. E.; J. R. Webster and J. B. Wallace. SESTON DYNAMICS IN SOUTHERN APPALACHIAN STREAMS: EFFECTS OF CLEAR-CUTTING. *Can. J. Fish. Aquatic Sci.* 37(4):624-631. Apr. 1980. SFA 25(2)
[J. R. Webster: Dep. Biol., VPI&SU, Blacksburg, VA 24061]

80-001730 Holland, H. T.; J. R. Chambers and R. R. Blackman. EFFECTS OF DREDGING AND FILLING FOR BEACH EROSION CONTROL ON FISHES IN THE VICINITY OF LIDO KEY, FLORIDA. *U.S. Army Corp Eng., Jacksonville, Fla.* 28p. Mar. 1980. SFA 25(2)
[U.S. Army Corps Eng., P.O. Box 4970, Jacksonville, FL 32201] Fish populations in the vicinity of Lido Key, Florida, were studied before (one survey) and after (four surveys) completion of a beach erosion control project utilizing an offshore borrow source. Fishes were collected with a trawl and beach seines during the period April 1970 to May 1971; a total of 63 species were collected, 58 by trawling and 26 in seines. Mean catch in trawl samples ranged from 10.2 in May of 1971 to 91.1 in October 1970, whereas seine catches ranged from 27.3 in April 1970 to 163.2 in July 1970. The most numerous species for all collections was *Menticirrhus littoralis*, followed by, in order of decreasing abundance, *Harengula pensacolae*, *Bairdiella chrysura*, *Chloroscombrus chrysurus*, and *Cynoscion arenarius*. The data suggest that the beach erosion control project resulted in at least a temporary increase in fishes along the beach and near the borrow area. Further detailed investigations appear warranted in view of the limitations of the present study and the increasing Federal and State role in restoring eroded or eroding beaches.

80-001731 Marsh, P. C. and T. F. Waters. EFFECTS OF AGRICULTURAL DRAINAGE DEVELOPMENT ON BENTHIC INVERTEBRATES IN UNDISTURBED DOWNSTREAM REACHES. *Trans. Am. Fish. Soc.* 109(2):213-223. Mar. 1980. SFA 25(2)
[Dep. Entomol. Fish. Wildl., Univ. Minn., St. Paul 55108]

80-001732 Parkinson, E. A.; P. A. Slaney and T. G. Halsey. SOME EFFECTS OF FOREST HARVESTING ON A CENTRAL INTERIOR LAKE IN BRITISH COLUMBIA. *British Columbia Minist. Recreation Conserv. Fish. Manage. Rep.* No. 17. 48p. Sept. 1977. SFA 25(2)
[Fish. Wildl. Br., Fish. Res. Tech. Serv. Sect., c/o I.A.R.E., Hut B-8, Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

80-001733 Raymond, H. L. EFFECTS OF DAMS AND IMPOUNDMENTS ON MIGRATIONS OF JUVENILE CHINNOK SALMON AND STEELHEAD FROM THE SNAKE RIVER, 1966 TO 1975. *Trans. Am. Fish. Soc.* 108(6):505-529. Nov. 1979. SFA 25(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-001734 Robinson, J. L. and M. A. Smith. STREAM MORPHOLOGY IN TWO ADJACENT GRAZING SYSTEMS OF MEDICINE BOW MOUNTAINS OF WYOMING. *J. Colo.-Wyo. Acad. Sci.* 12(1):12. Apr. 1980. Abstract only. SFA 25(2)

HABITAT ALTERATIONS

80-001734 CONTINUED
[Univ. Wyo., Laramie] This report presents the results of studies conducted on Pole Mountain, in the Medicine Bow National Forest, East of Laramie, Wyoming. This study evaluated stream morphology in continuous and deferred rotation grazing allotments. Seven (7) parameters were studied in each allotment along two stream flowing through both allotments. An increase in undercut banks was noted in the deferred allotment. Undercut banks are indicative of bank stability and are valuable trout cover. Increased bank stability was also indicated by an increase in stream/channel width ratio and improvements in percent of channel depth with water, steeper bank slope, coarser bottom materials, and better length and dispersion of pools, riffles, and runs in the deferred rotation grazing allotment. An unexpected finding was noted in overhead cover. The continuous grazing allotment had the highest total percent of cover over water. This was due primarily to washed in debris from dead woody species. The value of the washed in debris to any given site is limited because of its transitory nature. The washed in debris is more indicative of the loss of live woody species. Fish population surveys provided by Wyoming Game and Fish indicate population increases in Brook trout in the deferred/rotation streams. Survey data indicates Brook trout populations increased 226% in pounds per acre and 39% in the number of trout per mile. The combined results of this study, especially in light of the fish population increase, suggests the value of deferred grazing as a fisheries management tool.

80-001735 Shuldiner, P. W.; D. F. Cope and R. B. Newton. ECOLOGICAL EFFECTS OF HIGHWAY FILLS ON WETLANDS. USER'S MANUAL. *Natl. Coop. Highway Res. Prog. Rep.* 218B. 99p. Dec. 1979. SFA 25(2)
[Univ. Mass., Amherst]

80-001736 Slaney, P. A.; T. G. Halsey and A. F. Tautz. EFFECTS OF FOREST HARVESTING PRACTICES ON SPAWNING HABITAT OF STREAM SALMONIDS IN THE CENTENIAL CREEK WATERSHED, BRITISH COLUMBIA. *British Columbia Minist. Recreation Conserv. Fish. Manage. Rep.* No. 73. ii + 45p. Nov. 1977. SFA 25(2)
[Fish. Wildl. Br., Fish. Res. Tech. Serv. Sect., c/o I.A.R.E., Hut B-8, Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

80-001737 Thorhaug, A. and J. H. Marcus. POTENTIAL ARTIFICIAL REEFS CREATED BY THE PRESENCE OF OCEAN THERMAL ENERGY CONVERSION (OTEC) PLANTS. *Fla. Sci.* 43(Suppl. 1):18. 1980. Abstract only. SFA 25(2)
[Fla. International Univ., Tamiami Campus, Miami 33199] It is likely that organisms (attached algae, coral, invertebrates and browsing fish) will be attracted to and/or attach to Ocean Thermal Energy Conversion (OTEC) structures creating an artificial reef. Growth-promoting substances such as nitrogen and phosphate, heat and increased lighting could create an area of fertility surrounding the plant which would enhance the productivity of such a reef. A literature survey has been undertaken to assemble available information on colonization of existing structures submerged in localities similar to those proposed for OTEC, e.g., oil platforms, buoys, light ships and long ocean piers. Information is also being gathered on major attached organisms, e.g., their biological mass and colonization rate, at the Mini-OTEC and OTEC-1 sites in Hawaii and also at proposed sites such as Tampa, Puerto Rico and Miami.

80-001738 Walton, J. M. PUGET SOUND ARTIFICIAL REEF STUDY. *Ph.D. dissertation, Univ. Wash.* 142p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2494. Dec. 1979. SFA 25(2)

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80-001738 CONTINUED
Eight artificial reef habitats were surveyed through the use of SCUBA transects for density, biomass and species assemblages of potential sport species of fish from April 1975 to May 1978. The open sand bottom at a depth of 6 to 18 m and four existing artificial habitats, including a quarry rock breakwater, a rubble rock pipeline covering, a concrete sewage outfall block and several sunken boat hulls preserved as an underwater park, were surveyed the first year. Four reef configurations utilizing automobile tires were designed, constructed, and evaluated during the latter period of the study. These structures included a flatsquare, triads, horseshoes and pyramids. Five species of flatfish were commonly associated with the open sand bottom at a density of .06 fish/m^2 and a fish biomass of 6.9 g/m^2. The average density of 24 species of fish on the existing artificial habitats (.23 fish/m^2) was about 4 times greater than determined for the flatfish on the sand bottom, and the average biomass (50.2 g/m^2) was about 9 times greater. The optimum reef structure was the medium high relief triad design with an average density estimate of 2.13 fish/m^2 and a biomass estimate of 285.7 g/m^2. The horse shoe-shaped tire reefs, designed to concentrate flatfish, yielded mean flatfish, density and biomass estimates about 4 times greater than that observed on the open sand. The average density of fish on all the tire reef structures was .53 fish/m^2 and the biomass 56.7 g/m^2 or about 8 times that observed on the open sand. Three species of surfperch, family Embiotocidae, accounted for 65% of the density and 30% of the biomass of the fish present. Rockfishes of the family Scorpaenidae comprised 33% of the density and about 53% of the biomass. Although the artificial reefs hosted about 16 times the fish density found on natural reefs in Puget Sound, the biomass was about the same.--From abstr.

80-001739 Woods, P. F. DISSOLVED OXYGEN IN INTRAGRAVEL WATER OF THREE TRIBUTARIES TO REDWOOD CREEK, HUMBOLDT COUNTY, CALIFORNIA. *Water Resour. Bull.* 16(1):105-111. Feb. 1980. SFA 25(2)
[USGS, Helena, MT 59601] As a part of a study of Redwood National Park in northwestern California, an investigation was conducted from June to November 1974 on intragravel dissolved oxygen and sediment in three tributaries to Redwood Creek, a major coastal stream that flows through Redwood National Park. Of concern was whether the intragravel environment of streams in logged and unlogged redwood-forested drainage basins was different. The tributary in the unlogged drainage basin had lower percentages of fine streambed sediment than either of the tributaries in logged drainage basins. Concentration and percentage saturation of dissolved oxygen of intragravel water were highest in the stream in the unlogged drainage basin, intermediate in the stream in the patch-cut drainage basin, and lowest in the stream in the clear-cut drainage basin. The differences in intragravel dissolved-oxygen conditions among the three tributaries are attributed chiefly to differences in their interchange of surface and intragravel water. The larger quantities of fine streambed sediment in the two streams in logged basins may have reduced the permeability of the streambeds and hence their capacity to interchange surface and intragravel water. However, differences in the lithology of the three tributary drainage basins examined may contribute to the differences in the percentage of fine sediments observed among the streams, even in the absence of logging.

HARVEST, CREEL CENSUS, ETC.

80-001740 Alexander, C. M. and J. A. Holbrook II. COMPARISON OF BASS CLUB RECORDS WITH CREEL CENSUSES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:446-448. 1978[1979]. SFA 25(2)

HARVEST, CREEL CENSUS, ETC.

80-001740 CONTINUED
[TVA, Norris, TN 37828] Bass club catch records from tournaments held on Norris, Douglas, and Cherokee Reservoirs during 1976 were compared with creel censuses. While not statistically significant, both numbers and weights per hour of bass caught by tournament anglers were less than catch rates by nontournament fishermen. Average weight of bass caught in tournaments was higher than that found in creel censuses. Some advantages of using tournament catch records in evaluating bass fisheries are discussed.

80-001741 Christensen, D. J. and W. J. Clifford. COMPOSITION OF CATCHES MADE BY ANGLERS FISHING FOR SUMMER FLOUNDER, *PARALICHTHYS DENTATUS*, FROM NEW JERSEY PARTY BOATS IN 1978. *Mar. Fish. Rev.* 41(12):28-30. Dec. 1979. SFA 25(2)
[NMFS, Sandy Hook Lab., Highlands, NJ 07732] Anglers were interviewed while fishing for summer flounder, *Paralichthys dentatus* along the New Jersey coast from party boats. Mean seasonal catch rates for full-day and half-day anglers were 3.15 and 1.86 summer flounder per man per trip, respectively, from 19 June to 1 September 1978. Other fish species made up less than 10 percent of the catch. A total of 828 summer flounder were measured and ages were determined for 427 specimens. Analysis of the age-length data indicates that II +, III +, IV +, V +, and >V + age summer flounder made up 4.3, 73.0, 20.3, 1.8, and 0.6 percent of the catch, respectively.

80-001742 Hanson, W. D. and J. G. Dillard. RECREATIONAL USE OF THOMAS HILL RESERVOIR AND ADJOINING LANDS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:459-469. 1978[1979]. SFA 25(2)
[Mo. Dep. Conserv., Columbia 65201] An estimate of the total recreational use of the Thomas Hill Wildlife Area (1,778 ha reservoir and 2,424 ha of adjoining lands) in northern Missouri was made from 1 July 1972 to 30 June 1974. Recreational activity was determined by interviewing departing recreationists utilizing the non-uniform probability sampling technique. There were an estimated 219,700 recreational trips totaling 1,398,900 hours during the 2-year study. Twenty-two recreational activities were measured. Seven recreational uses; sight-seeing, boating, fishing, camping, swimming, picnicking, and hunting accounted for over 99% of all the trips and hours. Sight-seeing made up 25%, boating 21%, angling 20%, camping 16%, and swimming 9% of the total trips. However in hours, camping made up 42%, boating 22%, angling 21%, and swimming 6% of the total. There were 63 trips per water surface ha and approximately 45 trips per land surface ha. Anglers caught an estimated 172,100 fish during the study. A catch rate of 0.6 fish per hour provided a harvest of 97 fish per ha. White crappie (*Pomoxis annularis*) (87%) dominated the catch. Deer, rabbits, squirrels, predators, quail, and ducks were harvested. Harvest rates varied from 0.1 per hour for predators to 0.7 per hour for squirrels. Local residents made up 48% of all visitors while 78% came from within a 120-km radius. Recreationists came from 56 Missouri counties and from out-of-state. About 48% of all visitors held some type of Department license; many who did not were too young or too old to need a fishing license. The Thomas Hill Wildlife Area increased available public recreational opportunity in this region of the state and was important to North Central Missourians.

80-001743 Hess, T. B. CHARACTERISTICS OF 1975-76 GEORGIA RESIDENT FISHING LICENSE HOLDERS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:727-731. 1978[1979]. SFA 25(2)
A 1975-76 resident fishing license holder survey was conducted to obtain data on the characteristics of Georgia anglers. Sixty-four percent of all anglers were men. The average number of fishing trips per person per year was

HARVEST, CREEL CENSUS, ETC.

80-001743 CONTINUED 17. More anglers fished in ponds at least once (51%) than in any other type of water. Mountain streams supported the heaviest fishing pressure (182 trips/ha). Nearly half of all anglers (45%) supported an increase in license fees if the funds were used solely for fisheries management purposes.

80-001744 Howard, I. C. OPINIONS, PREFERENCES, SATISFACTIONS, AND IMPORTANCE OF WOMEN ANGLERS IN MASSACHUSETTS. *Fisheries (Bull. Am. Fish. Soc.)* 4(6):32-34. Nov.-Dec. 1979. SFA 25(2)
[185 Allen Ave., Newton, MA 02168]

80-001745 Internation Commission for the Northwest Atlantic Fisheries. LIST OF NORTHWEST ATLANTIC SPECIES ARRANGED ACCORDING TO THE ICNAF GROUPS. *Int. Comm. Northwest Atl. Fish. Stat. Bull.* 27:1-229. 1979. SFA 25(2)
[Dartmouth, Nova Scotia, Canada]

80-001746 King, T. R.; R. R. Thompson and J. C. Buntz. COMPARISON OF ATTITUDES OF AVERAGE FISHERMEN AND FISHING CLUB MEMBERS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:657-665. 1978[1979]. SFA 25(2)
[Commum. Res. Cent., Fla. State Univ., Tallahassee 32306] A telephone survey was conducted of a stratified, random sample of people holding Florida fishing licenses and of a random sample of members of selected fishing clubs. Questions were asked concerning demographic characteristics, their fishing habits and preferences, opinions about the Florida Game and Fresh Water Fish Commission and its projects, and their sources of information on freshwater fishing topics. A statistically significant difference was found between the responses of the average fishermen and the fishing club members in 72% of the questions asked in the survey.

80-001747 Manning, R. E. BEHAVIORAL CHARACTERISTICS OF FISHERMEN AND OTHER RECREATIONISTS ON FOUR VERMONT RIVERS. *Trans. Am. Fish. Soc.* 108(6):536-541. Nov. 1979. SFA 25(2)
[Sch. Nat. Resour., Univ. Vt., Burlington 05405]

80-001748 Oliphant, M. S. CALIFORNIA MARINE FISH LANDINGS FOR 1976. *Calif. Dep. Fish Game Fish Bull.* 170. 56p. 1979. Available from Mar. Tech. Inf. Cent., Calif. Dep. Fish Game, 350 Golden Shore, Long Beach 90802. SFA 25(2)

REGULATIONS

80-001749 Bouc, K. FISHING'S FUTURE WALLEYE SIZE LIMIT. *Nebraskaland* 58(4):14,48,50. Apr. 1980. SFA 25(2)

80-001750 Huntsman, G. R. and C. S. Manooch III. MINIMUM SIZE LIMITS FOR REEF FISHES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:509-513. 1978[1979]. SFA 25(2)
[NMFS, Southeast Fish. Cent., Beaufort Lab., Beaufort, NC 28516] Implementation of minimum size limits is an administratively simple method of maximizing yield-per-recruit and, probably, total yield from reef fisheries. However, size limits may not guarantee ample escapement to older ages and, consequently, adequate reproduction of those species which undergo sex reversal. Further, size limits may place unacceptably severe restriction on

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80-001750 CONTINUED certain portions of reef fisheries. Finally, most undersize reef fishes taken by hook and line from deep water will likely die of injuries caused by the pressure change. Based on growth data of fishes from the United States South Atlantic, Gulf of Mexico or southern Caribbean, size limits (TL) that would maximize yield-per-recruit for the following species are: *Pagrus pagrus*, 369 mm; *Rhomboplites aurorubens*, 324 mm; *Haemulon plumieri*, 314 mm; *Lutjanus campechanus*, 407 mm; *Lutjanus synagris*, 356 mm; *Ocyurus chrysurus*, 403 mm; *Centropristis striata*, 233 mm; *Epinephelus morio*, 635 mm; *Epinephelus guttatus*, 363 mm; and *Mycteroperca microlepis*, 649 mm.

80-001751 Kushnarenko, A. I. THE MINIMUM COMMERCIAL SIZE AND NATURAL MORTALITY OF THE NORTH CASPIAN ROACH, *RUTILUS RUTILUS CASPICUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(6):886-895. 1978. SFA 25(2)
[Caspian Fish. Res. Inst., Astrokhan, USSR] The effectiveness of the existing minimum commercial size on *Rutilus rutilus caspicus* is considered. The biomass of the North Caspian roach reaches its maximum in 3-year-old fish from catches with commercial seines and in 2-year-old fish from catches with experimental (fine-mesh) seines. Presentday fishing gear, which catches mainly 5-year-old fish, clearly does not effectively utilize the North Caspian roach. Categories of mortalities have been established. Mortality due to natural causes are 87.475 X 10^6 kg (11.965.1 X 10^6 fish), of which 75.2% (by weight) and 98.7% (by number) are fish not of commercial size. The natural mortality of the North Caspian roach is more than 4 times the fishing mortality. It is proposed to increase the catch by rational exploitation of the age groups of sexually mature fish.

80-001752 Weithman, A. S. RECYCLING TROUT... *Mo. Conserv.* 41(3):8-9. Mar. 1980. SFA 25(2)
[Mo. Dep. Conserv., Columbia]

FISH CONTROL AND REMOVAL

80-001753 Flint, R. A. CHEMICAL TREATMENT OF THE NORTH FORK FEATHER RIVER, BUTTE AND PLUMAS COUNTIES, CALIFORNIA, 1977. *Calif. Dep. Fish Game Inland Fish. Admin. Rep.* No. 80-4. 25p. Feb. 1980. SFA 25(2)
In September and October 1977 the California Department of Fish and Game chemically treated 35 miles of streams and 194 acres of reservoirs in the North Fork Feather River drainage in an effort to greatly reduce hardhead, *Mylopharodon conocephalus*; Sacramento squawfish, *Ptychocheilus grandis*; and Sacramento sucker, *Catostomus occidentalis*. Rotenone was used in the reservoirs and parts of the streams at application rates of 0.025 to 0.055 mg/l (ppm) active ingredient. Antimycin A was applied to other parts of the streams at rates of 11.4 to 17.1 µg/l (ppb) active ingredient. Total project cost was $13,231, with $8,705 expended for chemicals. After treatment the streams and reservoirs were restocked in 1977 with 20,010 fingerling rainbow trout, *Salmo gairdneri* and 41,420 fingerling brown trout, *Salmo trutta*. Angling regulations were changed to a two-fish daily limit, with the intention of managing the system as a trophy trout fishery and to encourage predation by trout on nongame fish to prevent their reestablishment as the dominant fishes.

MARKING AND TAGGING

80-001754 Bryant, M. D. and W. J. Walkotten. CARBON DIOXIDE FREEZE-BRANDING DEVICE FOR USE ON JUVENILE SALMONIDS. *Prog. Fish-Cult.* 42(1):55-56. Jan. 1980. SFA 25(1)
[U.S. For. Serv., Pac. Northwest For. Range Exp. Stn., Juneau, AK 99801]

80-001755 Gunnes, K. and T. Refstie. COLD-BRANDING AND FIN-CLIPPING FOR MARKING OF SALMONIDS. *Aquaculture* 19(3):295-299. Mar. 1980. SFA 25(2)
[Dep. Anim. Genet. Breed., Agric. Univ. Norway, 1432 ÅS-NLH, Norway] Identification of individual fish is important under many research circumstances and is essential in breeding and selection work. Results are presented from the marking system used at the Norwegian Research Station for Salmonids. Trained personnel and good light conditions are necessary to obtain a high percentage of correct identifications. The best result obtained was 99% identification 22-28 months after marking. It is estimated that 1.4% of the fish read were incorrectly identified. The frequency of misidentified fish was higher when different cold-branded symbols were included in the system, increasing to a mean of 8% for salmon and 15% for rainbow trout. Cold-branding using five different symbols at two of six different positions on the fish gives 600 permutations when used in conjunction with clipping of the adipose and right or left pelvic fins. A satisfactory degree of correct identification is possible for use in a programme of selection in salmonids.

80-001756 Hedgepeth, M. Y.; W. H. Kriete, Jr. and J. V. Merriner. DETERIORATION OF FLOY FD-67 INTERNAL ANCHOR TAGS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:648-656. 1978[1979]. SFA 25(2)
[Va. Inst. Mar. Sci., Gloucester Point 23062] Yellow Floy FD-67 internal anchor tags were utilized in an experimental and field study of tag discoloration, tag legibility and fouling organisms. Most tags exhibited some degree of discoloration over time. The rate and extent of discoloration varied between two batches of tags purchased in different years. The legibility of a tag was not affected to a great extent by the degree of discoloration. Legends of some completely discolored tags were still readable. Fouling organisms eroded the vinylite covering and deteriorated the legends of some tags. Bryozoans, barnacles and tunicates were the most commonly encountered fouling organisms. Barnacles were the most erosive of these organisms. Other causes of tag discoloration were believed to be chemical reactions between the vinylite covering and environmental factors such as salt concentration.

80-001757 Russell, H. J., Jr. ANALYSIS OF DOUBLE-TAGGING EXPERIMENTS: AN UPDATE. *Can. J. Fish. Aquatic Sci.* 37(1):114-116. Jan. 1980. In English with French summ. SFA 25(2)
[New England Fish. Manage. Counc., Peabody, MA 01960]

STOCKING AND INTRODUCTIONS

80-001758 Axon, J. R. AN EVALUATION OF STRIPED BASS INTRODUCTIONS IN HERRING LAKE. *Ky. Dep. Fish. Wildl. Resour. Fish. Bull.* No. 63. 33p. Oct. 1979. SFA 25(2)
[100 Buffalo Tr., Frankfort, KY 40601] Herrington Lake was stocked with sub-adult striped bass in 1958 and 1960-62. One- to two-inch fingerlings were introduced in 1969-70 and 1973-78. The fingerling stocking rate in 1973-78 was about 20 fish per acre. Evaluation studies such as water quality determinations, fish population sampling with gill nets, electrofishing, rotenone, food habits, creel surveys, a mail-in survey, and age and growth surveys were conducted in 1973-78 to determine the success of stockings in those years. The purposes of stocking striped bass in Herrington Lake were to utilize the open-water habitat that most of the lake represented, utilize the

STOCKING AND INTRODUCTIONS

80-001758 CONTINUED abundant gizzard and threadfin shad populations, and develop a put-grow-take fishery that would, in part, provide trophy-size fish to Kentucky anglers. The first two objectives were accomplished, and part of the third goal was achieved by providing trophy-size fish. A striped bass fishery did develop, but only during the summer months, if one describes the fishery as that in which an angler fishing for striped bass could expect to catch one. The best harvest was 0.25 pound per acre in 1978. A one percent increase in the sport fish harvest was accomplished in 1975 due to the addition of striped bass to the creel. Two limiting factors, a lack of fishing interest for striped bass and a high natural mortality period for adult striped bass in late summer, prevented a fishery from developing. Future striped bass stockings after 1978 were not recommended. A hybrid between the striped bass and white bass was recommended for annual stocking, instead. Management objectives of developing a put-grow-take fishery where at least one pound of fish is harvested per acre and an increase of the sport fish harvest by at least ten percent were not accomplished by stocking striped bass. These objectives, however, are expected to be achieved by introductions of the hybrid.

80-001759 Henry, F. D., Jr. THE INTRODUCTION OF SOUTHEASTERN BLUEGILL, *LEPOMIS MACROCHIRUS PURPURESCENS*, INTO LAKE PERRIS, CALIFORNIA, WITH NOTES ON THE GROWTH OF THE INITAL YEAR CLASS. *Calif. Fish Game* 66(1):62-64. Jan. 1980. SFA 25(2)
[Calif. Dep. Fish Game, Operations Res. Br., 2201 Garden Rd., Monterey 93940]

80-001760 Lee, D. P. 1974-76 TAGGING STUDIES AT FRESHWATER LAGOON, HUMBOLDT COUNTY. *Calif. Dep. Fish Game Inland Fish. Admin. Rep.* No. 80-3. 9p. Feb. 1980. SFA 25(2)
Angler harvest of catchable-sized trout released in Freshwater Lagoon was evaluated in 1974 and 1975 using $5.00 reward tags. Anglers returned 68% of the tags from the September 1974 release but only 20%, 20%, and 26% of the tags from the May, June, and July 1975 releases, respectively. A Chi-square test showed angler returns of tags from the 1974 fall release to be significantly greater than from the combined 1975 spring and early summer releases, but no significant difference existed among the spring and early summer releases. Angler returns of Whitney strain rainbow catchables and Eagle Lake trout x Coleman strain rainbow catchable hybrids were compared using nonreward tags in 1976. No significant difference was found in the overall return rate of these two groups. Recommendations for management of Freshwater Lagoon are also presented.

80-001761 Reisenbichler, R. R. and N. A. Hartmann, Jr. EFFECT OF NUMBER OF MARKED FISH AND YEARS OF REPETITION ON PRECISION IN STUDIES OF CONTRIBUTION TO A FISHERY. *Can. J. Fish. Aquatic Sci.* 37(4):576-582. Apr. 1980. SFA 25(2)
[U.S. FWS, P.O. Box 667, Red Bluff, CA 96080]

80-001762 Rogers, R. D. HARVEST OF FOUR STRAINS OF RAINBOW TROUT IN JACKSON MEADOWS RESERVOIR, CALIFORNIA. *Calif. Dep. Fish Game Inland Fish. Admin. Rep.* No. 80-2. 19p. Feb. 1980. SFA 25(2)
Four strains of rainbow trout were fin clipped and stocked in Jackson Meadows Reservoir, Sierra and Nevada counties, in 1973 to test their relative contributions to the sport fishery. Strains were as follows: (i)

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80-001762 CONTINUED rainbow-Shasta, *Salmo gairdneri*, (ii) rainbow-Coleman, *S. gairdneri*, (iii) rainbow-Kamloops, *S. gairdneri*, and (iv) rainbow-Kamloops x Lahontan cutthroat, *Salmo clarki henshawi*. The domestic Shasta and Coleman strains, stocked as fingerlings, had negligible returns and a high cost to the anglers' creel. The progeny of wild parents, Kamloops and the hybrid Kamloops x Lahontan cutthroat trout, were stocked at subcatchable size and had satisfactory returns. Kamloops performed best, having the highest catch rate and lowest cost to the anglers' creel. Superior performance of Kamloops was attributed to its larger size at the time of stocking. Most of the marked fish were caught during the spring of their second year in the lake, with boat anglers taking more and larger fish than shore anglers.

80-001763 Scarnecchia, D. L. and H. H. Wagner. CONTRIBUTION OF WILD AND HATCHERY-REARED COHO SALMON, *ONCORHYNCHUS KISUTCH*, TO THE OREGON OCEAN SPORT FISHERY. *NOAA Fish. Bull.* 77(3):617-623. July 1979. SFA 25(2)

[Colo. Coop. Fish. Res. Unit, Colo. State Univ., Fort Collins 80523] Eight scale characters of known hatchery and wild coho salmon, *Oncorhynchus kisutch*, were compared, and a linear discriminant fuction was used to determine whether hatchery and wild adult coho salmon could be reliably separated on the basis of scale characteristics. Attempted separation was based upon known differences in rearing environments of hatchery and wild juvenile coho salmon and upon hatchery smolts being larger than wild smolts. Identifications were correct for 82% of the hatchery fish and 89% of the wild fish. Based on analysis of scales from adult coho salmon of unknown origin (hatchery or wild) and the estimated catch of marked, hatchery-reared coho salmon taken by the Oregon sport fishery, we concluded that 75% of the fish caught in the ocean along the Oregon coast from mid-June to mid-September 1977 had been released as smolts from hatcheries. Percentages of hatchery fish in the catch ranged from 85 near the mouth of the Columbia River to 61 at Winchester Bay on the central Oregon coast. Fisheries along the south and central Oregon coast may have had access to higher percentages of wild coho salmon after mid-August than prior to this time, probably because wild fish from coastal streams remained near these ports, whereas most fish destined for Columbia River hatcheries had already migrated northward.

80-001764 Schneider, J. C. SURVIVAL, GROWTH, AND VULNERABILITY TO ANGLING OF WALLEYES STOCKED AS FINGERLINGS IN A SMALL LAKE WITH YELLOW PERCH AND MINNOWS. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1875. 20p. 27 Dec. 1979. SFA 25(2)

[Inst. Fish. Res., Mus. Annex, Ann Arbor, MI 48109] An experimental fish community comprised of fathead minnows, yellow perch, and walleyes was established in Jewett Lake. Fingerling walleyes about 150 mm long were stocked at the rate of 62 per hectare each fall for three consecutive years once the other species were established. Abundance, survival, growth, and food habits were monitored up through the fourth year. The fish community developed about as predicted from earlier studies. A large population of minnows was replaced by large, balanced populations of yellow perch and walleye. By the fourth year, survival of the three walleye plantings ranged from 0.071 to 0.708, depending at planting time on length of planted fingerling, abundance of food of the appropriate size, and density of older walleyes in the lake. Walleye mortality was highest during the first year in the lake (especially in the first month), and low in subsequent years. Test anglers found the walleyes and yellow perch fairly easy to catch. This type of fish community has good potential for fisheries management.

FISHING GEAR AND TECHNIQUES

80-001765 Beene, E. L. and A. M. Landry, Jr. THE ROLLER-NET: A NEW MARINE SAMPLING GEAR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:517-519. 1978[1979]. SFA 25(2)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843] The roller-net, a new fisheries sampling gear incorporating features common to the pushnet and bag seine, is described. The roller-net is compared with nearshore gear types, including pushnet, bag seine, and minnow seine, in beachfront, grassbed, barren sand-shell, and soft organic substrates. The roller-net is effective in sampling nekton from grassbed and barren sand-shell substrates, but ineffective in characterizing beachfront and soft organic substrates.

80-001766 Colton, J. B., Jr.; J. R. Green; R. R. Byron and J. L. Frisella. BONGO NET RETENTION RATES AS EFFECTED BY TOWING SPEED AND MESH SIZE. *Can. J. Fish. Aquatic Sci.* 37(4):606-623. Apr. 1980. SFA 25(2)
[Narragansett Lab., Narragansett, RI 02882]

80-001767 Elder, J. A.; J. W. Icanberry; D. J. Smith; D. G. Henriet and C. E. Steitz. ASSESSMENT OF A LARGE-CAPACITY FISH PUMP FOR SAMPLING ICHTHYOPLANKTON FOR POWER-PLANT ENTRAINMENT STUDIES. *Calif. Coop. Oceanic Fish. Invest.* 20:143-145. Oct. 1979. SFA 25(2)
[BioSystems Analysis, Inc., 1455 Airport Blvd., San Jose, CA 95110]

80-001768 Imai, T. [BASIC STUDIES ON THE PLANE NET SET INTO THE FLOWING WATER--IV. COMPARATIVE STUDY OF HYDRO-DYNAMICAL RESISTANCE ON KNOTTED AND KNOTLESS NETTINGS]. *Bull. Jpn. Soc. Sci. Fish.* 45(10):1277-1282. Oct. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Gear, Fac. Fish., Kagoshima Univ., Kagoshima, Japan]

80-001769 Kawamura, G. [FUNDAMENTAL STUDY ON APPLICATION OF THE VISION OF SPOTTED MACKEREL, *PNEUMATOPHORUS TAPEINOCEPHALUS* (BLEEKER), TO ANGLING TECHNIQUES--VII. MOVEMENTS OF FISH SCHOOL ATTRACTED TO FISH LAMP OBSERVED BY FISH FINDER.] *Bull. Jpn. Soc. Sci. Fish.* 45(11):1355-1358. Nov. 1979. In Japanese with English summ. SFA 25(2)
[Lab. Fish. Technol, Fac. Fish., Kagoshima Univ., Kagoshima, 890 Japan]

80-001770 Laarman, P. W. and J. R. Ryckman. SIZE SELECTIVITY OF TRAP NETS FOR EIGHT SPECIES OF FISH. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1880. 16p. 25 Jan. 1980. SFA 25(2)
[Mich. Dep. Nat. Resour., East Lansing] Size selectivity of trap nets was determined from the ratio of recaptured fish of various lengths to the number of marked fish in the population. The nets operated in Manistee Lake (348 ha) from mid-September to mid-October (1974-1978) were size selective for six of eight species of fish. In general, nets were selective for the larger sizes of bluegills, pumpkinseeds, rock bass, black crappie, and yellow perch. Walleyes about 55 cm long and larger were more catchable than smaller sizes. Significant size selectivity was not evident for smallmouth bass and white suckers.

80-001771 Lancraft, T. M. and B. H. Robison. EVIDENCE OF POSTCAPTURE INGESTION BY MIDWATER FISHES IN TRAWL NETS. *NOAA Fish. Bull.* 77(3):713-715. July 1979. SFA 25(2)
[Mar. Sci. Inst., Univ. Calif., Santa Barbara 93106]

FISHING GEAR AND TECHNIQUES

80-001772 Maciolek, J. A. and A. S. Timbol. ELECTROSHOCKING IN TROPICAL INSULAR STREAMS. *Prog. Fish-Cult.* 42(1): 57-58. Jan. 1980. SFA 25(2)
[NMFS, Bldg. 204, Naval Support Activity, Seattle, WA 98115]

80-001773 Perry, W. G. SLAT TRAP EFFICIENCY AS AFFECTED BY DESIGN. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:666-671. 1978[1979]. SFA 25(2)
[La. Dep. Wildl. Fish., Grand Chenier 70643] This study contained 12 treatments consisting of 6 different trap designs; 6 were baited and 6 were not. A total of 2,770 catfish, blue (*Ictalurus furcatus*) and channel (*I. punctatus*) combined, weighing 984.0 kg was captured. Slat traps were highly selective for channel catfish. The highest individual catch was 40 kg by trap type E, a trap with 3.2 cm slat spacings on the rear portion of the sides and end. The sides around the front throats were solid. Highest total catch per trap day was in trap type F (2.5 cm spacing, closed sides around throats). Type F yielded 1.7 kg of channel catfish and 0.7 kg blue catfish per trap day. No statistical difference for total weight harvested was found when the 2 trap types B and E were compared to trap types C and F ($P>.05$). A highly significant difference existed between the catch of these traps for both species of catfish combined that were of a commercial size ($P<.01$). Trap type B had 3.2 cm slat spacings and types C and F each had 2.5 cm spacings. Type F, like type E, had solid sides around the front throats.

80-001774 Seawell, W. M. and K. W. Hevel. COMPARISON OF TWO METHODS OF RECAPTURING MARKED FISH FOR ESTIMATING BLACK BASS POPULATIONS IN A RESERVOIR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:437-445. 1978[1979]. SFA 25(2)
[TVA, Norris, TN 37828] The population of largemouth bass (*Micropterus salmoides*) in 2314-ha Melton Hill Reservoir, TN, was estimated by 2 mark and recapture methods. Shoreline electrofishing was used to capture fish for marking, while shoreline electrofishing and a bass fishing tournament were used to obtain recaptures. Both methods yielded estimates of the same magnitude; however, slightly different size selectivities were found with the 2 recapture methods. Species selectivity of shoreline electrofishing and the bass tournament are also compared. The population strucutre of the black bass population in Melton Hill Reservoir is examined and possible causes for this structure are presented.

80-001775 Shimamura, T. and H. Soeda. [THE CHANGE OF CATCH OF TUNA LONGLINE DEPENDS ON SOAKING TIME AND SOAKING TIME ZONE OF GEAR]. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1081-1084. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Coll. Agric. Vet. Med., Nihon Univ., 34-1, Shimouma, Setagaya-ku, Tokyo 154, Japan]

80-001776 Shinomiya, H. and M. Miyauchi. [OPTIMUM SPEED OF TUNA LONG LINE FISHING BOAT FOR DESIGNING]. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1075-1080. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Fac. Agric. Vet., Nihon Univ., Setagaya-ku, Tokyo 154, Japan]

80-001777 Smith, P. E. and S. L. Richardson. STANDARD TECHNIQUES FOR PELAGIC FISH EGG AND LARVA SURVEYS. *FAO Fish. Tech. Pap.* No. 175. 100p. 1977. SFA 25(2)
[NMFS, Southwest Fish. Cent., La Jolla, CA 92038]

FISHING GEAR AND TECHNIQUES

80-001778 Timmons, T. J.; W. L. Shelton and W. D. Davies. SAMPLING OF RESERVOIR FISH POPULATIONS WITH ROTENONE IN LITTORAL AREAS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:474-485. 1978[1979]. SFA 25(2)

[Ala. Coop. Fish. Res. Unit, Auburn Univ., Auburn 36830] A method of sampling fish populations in the littoral area of reservoirs was developed to estimate the number and standing stock of young-of-the-year (YOY) and adult fishes in West Point Reservoir, Alabama-Georgia. A surface area of 0.01 ha was surrounded with a net (30.5 m x 2.7 m) and the fish were poisoned with rotenone. The sample sites were chosen randomly by using a grid system. The average monthly standing stock (kg/ha) from April to September 1977 ranged from 74.2 in September to 126.1 in June. The weekly samples yielded data that enabled us to estimate the reproductive success and time of spawning for many species. We determined a weekly mortality rate of YOY largemouth bass (*Micropterus salmoides*) and could assess the availability of prey species. By using this method we sampled a wider variety of habitats and collected more species (34) than were taken in large rotenone samples from coves (29) or by electrofishing (28), and provided a reasonable estimate of standing stock in shallow littoral areas. The technique required only 2 people and little specialized equipment.

FERTILIZATION OF SOIL AND WATER

80-001779 Boyd, C. E.; J. W. Preacher and L. Justice. HARDNESS, ALKALINITY, pH AND POND FERTILIZATION. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 32:605-611. 1978[1979]. SFA 25(2)

[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36830] Many ponds in the southeastern United States have waters with less than 20 mg/l total alkalinity and should be limed to insure good response to inorganic fertilization. Water analysis is the only technique for determining if a pond needs liming, and the liming rate can best be estimated from a lime requirement determination of the bottom mud. In some waters total alkalinity may be high, but total hardness low. Such waters frequently develop dangerously high pH when fertilized. Alum rather than acid forming fertilizers should be used as emergency treatment to prevent fish kills during periods of high pH. Data on alkalinity and hardness are therefore needed when making fertilizer recommendations for individual ponds. Sufficiently accurate water analyses may be made with water analysis kits, provided reasonable care is exercised.

80-001780 El Samra, M. I. and J. Oláh. SIGNIFICANCE OF NITROGEN FIXATION IN FISH PONDS. *Aquaculture* 18(4):367-372. Dec. 1979. SFA 25(2)

[Inst. Oceanogr. Fish., Acad. Sci., Alexandria, Egypt] The magnitude of nitrogen fixation in an inorganic fertilized and cereal fed system (fish pond) was measured by an in situ application of the acetylene reduction method. The effects of inorganic fertilization were intensively examined. In comparison with natural lakes, the fish ponds exhibited a relatively low fixation rate. The midday nitrogen fixation rate was usually less than 30 µg at $N/m^2/h$. The total income was equal to 5.7 kg N/ha or 0.575 g N/m^2 for the growing season. Fish-induced bioperturbation and nitrogen fertilization, in the form of inorganic and organic fertilizers and foods, are considered to be the major regulatory factors in nitrogen fixation. major regulatory factors in nitrogen fixation.

80-001781 Helfrich, L. A. and L. A. Nielsen. SHOULD FISH PONDS BE FERTILIZED? THE LOW-DOWN ON THIS SHOULD SURPRISE YOU. *Va. Wildl.* 41(1):16-17. Jan. 1980. SFA 25(2)

[Cheatham Hall, VPI & SU, Blacksburg, VA 24061]

MATHEMATICS, STATISTICAL METHODS, AND MODELING

80-001782 Buyakas, V. I.; A. A. Darkov; D. V. Radakov and Yu. V. Chekalayev. A MATHEMATICAL MODEL OF THE MOVEMENT OF A FISH SCHOOL. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 18(5):822-831. 1978. SFA 25(2)
[A. N. Severtsov Inst. Evol. Morphol. Anim. Ecol., USSR Acad. Sci., Moscow, USSR] A mathematical model of the movement of a fish school was constructed, allowing for the main features of schooling behavior. The results of computer numerical integrations are given. The possibility of using the mathematical model to predict the behavior of fishes under particular environmental conditions is discussed.

80-001783 Cammen, L. M. ESTIMATION OF BIOLOGICAL POWER FUNCTIONS FROM GROUP MEASUREMENTS. *Can. J. Fish. Aquatic Sci.* 37(4):716-719. Apr. 1980. SFA 25(2)
[Bedford Inst. Oceanogr., P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada]

80-001784 Ebert, T. A. ESTIMATING PARAMETERS IN A FLEXIBLE GROWTH EQUATION, THE RICHARDS FUNCTION. *Can. J. Fish. Aquatic Sci.* 37(4):687-692. Apr. 1980. SFA 25(2)
[Dep. Biol., San Diego State Univ., San Diego, CA 92182]

80-001785 Thompson, R. W. and D. A. Cauley. POPULATION BALANCE MODEL FOR FISH POPULATION DYNAMICS. *J. Theor. Biol.* 81(2):289-307. 21 Nov. 1979. SFA 25(2)
[Dep. Chem. Eng., Worcester Polytech. Inst., Worcester, MA 01609] A population balance model of fish population dynamics for batch systems was developed. A growth rate expression was introduced and coupled with the population balance. Solutions of the model provide predictions of such fish size distribution characteristics as average size, standard deviation and coefficient of variation. A growth diffusivity mechanism was found to be inapplicable to systems where a terminal size is reached. A study of the two parameter growth rate expression was conducted, illustrating that conditions conducive to high growth rates also resulted in broadening of size distributions. The model was compared to data found in the literature to demonstrate its predictive capabilities.

LAKE MANAGEMENT AND RESEARCH

80-001786 Bandow, F. EFFECTS OF WINTERKILL AND CHEMICAL ERADICATION OF FISH ON A LAKE ECOSYSTEM. *Minn. Dep. Nat. Resour. Sect. Fish. Invest. Rep.* No. 369. 40p. Apr. 1980. SFA 25(2)
[Rt. 2, Box 105, Waterville, MN 56096] Chemical, physical, and biological characteristics of a shallow lake dominated by black bullheads were to be compared before and after reclamation with rotenone. The pretreatment phase was shortened to one summer by a winterkill in 1975 that nearly eliminated the bullhead population. The surviving bullhead population was treated with rotenone in the fall of 1975. In the three summers following the winterkill there was a substantial decline in chlorophyll *a* concentrations and a more moderate decline in primary production. Secchi disc visibility correspondingly increased and submerged macrophytes which initially were nearly absent at depths over 5 feet proliferated to occupy nearly the entire lake bottom. During the final summer the chlorophyll concentration reached a relatively low peak in early July and then declined despite relatively high nutrient concentrations. The postwinterkill years were characterized by increased numbers of large filter feeding zooplankters presumably as a result of reduced bullhead predation and to which the postwinterkill decline in

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80-001786 CONTINUED chlorophyll is largely attributed. The plankton Crustacea were substantially reduced by the rotenone and calanoid copepods, which dominated at the time of the treatment, never regained former abundance during the following two summers when, instead, *Daphnia* dominated the community. The chemical treatment may also have caused a change in the species composition of rotifers and a temporary reduction in some of the major benthic invertebrates.

80-001787 Carlander, K. D. WATER HYACINTH AND OVERFISHING PROBLEMS ON AN INDONESIAN LAKE. *Proc. Iowa Acad. Sci.* 87(1):20-22. Mar. 1980. Abstract only. SFA 25(2)

[Dep. Anim. Ecol., Iowa State Univ., Ames] Water hyacinths,. *Eichhornia crassipes*, and floating grass islands have been a serious problem for more than 50 years on Rawa Pening, a 2500-ha lake in central Java. Fish harvest increased with control of the plants in 1932-42 and 1951-56 but decreased as plants again increased in abundance. Control measures since 1962 have maintained open water but have not eliminated the problem. *Hydrilla verticillata* becomes abundant as the surface is cleared of water hyacinths. *Hydrilla* shelters *Macrobrachium* shrimp and other aquatic organisms, important to fish, and also is harvested for pig food. Annual fish yield dropped from about 530 kg/ha in 1972 to 178 in 1975 and to 18 kg/ha in 1978. Most species of fish averaged smaller in 1978 than in 1975. Overfishing is indicated, but the low catches are probably the result of other factors also.

80-001788 Francis, G. R.; J. J. Magnuson; H. A. Regier and D. R. Talhelm, eds. REHABILITATING GREAT LAKES ECOSYSTEMS. *Great Lakes Fish. Comm. Tech. Rep.* No. 37. 99p. Dec. 1979. SFA 25(2)

[Fac. Environ. Stud., Univ. Waterloo, Waterloo, ON N2L 3G1, Canada]

80-001789 Klein, W. D. KOKANEE IN PARVIN LAKE, COLORADO, 1972-1977. *Colo. Div. Wildl. Fish. Res. Sect. Spec. Rep.* No. 47. vi + 19p. Dec. 1979. SFA 25(2)

[538 S. Taft Hill Rd., Fort Collins, CO 80521] Kokanee were studied in Parvin Lake, a small, eutrophic lake in northern Colorado, to learn about the best ways to manage populations in this kind of environment. The study began with an experimental plant of 30,000 Flathead Lake-strain kokanee fry on May 10, 1972. Observations continued through the life cycle (age-group V+) of the salmon. Rainbow and brown trout were present in substantial numbers throughout the study. Fishing from 1972 to 1975 was restricted to artificial lures only and boats and other floating devices were prohibited. Overlaps in food habits and spatial distribution of kokanee and trout indicated that a potential existed for interactions between them that could be detrimental to the trout; however, conflicts would probably not develop at modest fish population levels. Significant direct or indirect conflicts between trout and kokanee were not documented. A pronounced outmigration of immature kokanee from the lake via the surface outlet occurred in July-August 1972 (age 0+ fish) and in May-June 1973. This egress was capable of reducing the lake population by 12.5 percent, with 8 percent assignable to the 1972 kokanee migrants. The kokanee catch consisted of 561 fish, or 1.87 percent of the original plant. Restrictions against bait and boat use probably severely restricted the catch. Angling appeared less efficient with each succeeding year from 1974 to 1976. Kokanee were most vulnerable to angling in August, and angler harvest in 1974 and 1975 was heavily biased toward mature fish. Estimates of kokanee biomass as well as estimates of the spawning populations and their sex-ratios were obtained. Kokanee could be used as a major or minor game fish at Parvin Lake, but any future use should entail late-summer or

LAKE MANAGEMENT AND RESEARCH

80-001789 CONTINUED fall fingerling plants. Also, other lakes that now receive kokanee fry plants and offer summer availability to a surface spillway should be considered for late-summer or fall fingerling plants.

80-001790 Lawrie, A. H. THE FISH COMMUNITY OF LAKE SUPERIOR. *J. Great Lakes Res.* 4(3/4):513-549. 1978. SFA 25(2)

[Res. Sect., Fish. Br., Ontario Minist. Nat. Resour., Box 50, Maple, ON L0J 1E0, Canada] Lake trout, lake whitefish, and their relatives characterize the fish community of oligotrophic Lake Superior. That community has been substantially altered by the direct and indirect effects of man's activities, generally in the direction of reduced diversity and depletion of many fish stocks. Long-continued heavy fishing, predation by and competition from invading exotic species, and environmental degradation have all played a role as have efforts to rehabilitate the community by introducing hatchery-reared fish of desired species. Community responses to these influences have been complex and although some are obvious and can be quantitatively modelled others reflect subtler, interactive responses to primary changes in abundance and size composition of various components of the community. Among the stresses whose roles remain to be clearly defined are the anthropogenic contaminants now know to occur, if only in small concentrations, in virtually all species. Although their impact on the welfare of individual fish stocks cannot be precisely defined at the moment their presence at all is profoundly disturbing.

80-001791 O"Neal, R. P. THE POTENTIAL FOR COMMERCIAL HARVEST OF UNDERUTILIZED FISH IN INLAND LAKES IN MICHIGAN. *M.S. thesis, Mich. State Univ.* 126p. 1978. From Masters Abstr. 17(4):241. Dec. 1979. SFA 25(2)

The primary species of underutilized fish in inland lakes in Michigan are carp (*Cyrpinus carpio*), white sucker (*Catostomus commersoni*), yellow bullhead (*Ictalurus natalis*), brown bullhead (*Ictalurus nebulosus*) and black bullhead (*Ictalurus melas*). White sucker is the primary commercial species in 54.9%, bullhead in 24.9% and carp in 20.2% of the designated inland waters of the state. Some 116,694 acres may be available for the commercial harvest of underutilized fish. Total acreage for each region of the state is: Region I-37,277 acres; Region II-63,868 acres; and Region III-15,549 acres. Based on preliminary biomass estimates, these waters support 7,996,425 pounds of rough fish, (Region I-1,453,803 pounds; Region II-4,023,684 pounds; and Region III-2,518,938 pounds). Other information discussed includes methods of harvest used in inland lakes, rough fish programs in other states, a review of the literature on rough fish management and some important aspects concerning this management.

80-001792 Schneider, J. C. and R. N. Lockwood. EFFECTS OF REGULATIONS ON THE FISHERIES OF MICHIGAN LAKES, 1946-65. *Mich. Dep. Nat. Resour. Fish. Res. Rep.* No. 1872. 247p. 20 Nov. 1979. SFA 25(2)

[Inst. Fish. Res., Mus. Annex, Ann Arbor, MI 48109] Creel census statistics and related data, collected 1946-65, are presented for 22 Michigan lakes where sport fishing regulations were tested. The main objective was to determine if increased fishing opportunity could be provided without damaging the populations or their fisheries. For panfish, removal of the closed spring season, removal of the 6-inch size limit, and removal of creel limits were tested. For game fish, length of the closed spring season, both high and low size limits, and a ban on northern pike spearing were tested. For rainbow trout stocked in lakes, spring and winter fishing seasons were tested. Most of the lakes were of the largemouth bass-bluegill type. It was difficult to accurately discern the effects of the fishing regulations because of imprecise statistics, a large increase in fishing pressure following World

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80-001792 CONTINUED War II, a widespread increase in fishing for bass coupled with a decrease in fishing for panfish during the 1950's, irregular recruitment, and other uncontrolled events. It is clear that, in general, no dramatic changes in fisheries or populations resulted; however, some experienced a gradual deterioration which may or may not be linked to the tests. It is recommended that game fish size limits and closed seasons be retained on most lakes in Michigan. Pumpkinseeds, rock bass, black crappie, and in some lakes largemouth bass and smallmouth bass, were especially vulnerable to spring fishing. Size limits typically had strong effects on the catches of bass and northern pike, as predicted by Latta (1972, 1974, 1975).

RIVER AND STREAM MANAGEMENT AND RESEARCH

80-001793 Bayha, K. INSTREAM FLOW METHODOLOGIES FOR REGIONAL AND NATIONAL ASSESSMENTS. *U.S. Fish Wildl. Serv.* FWS/OBS-78/61. xii + 98p. Dec. 1978. SFA 25(2)
[U.S. FWS, 2625 Redwing Rd., Fort Collins, CO 80526]

80-001794 Berg, R. SPOONBILL. *Mont. Outdoors* 11(3):11-13, 21-22. Mar.-Apr. 1980. SFA 25(2)

80-001795 Bowers, W.; B. Hosford; A. Oakley and C. Bond. WILDLIFE HABITATS IN MANAGED RANGELANDS--THE GREAT BASIN OF SOUTHEASTERN OREGON. NATIVE TROUT. *U.S. For. Serv. Pac. Northwest For. Range Exp. Stn. Gen. Tech. Rep.* PNW-84. 16p. 1979. Available from Pac. Northwest For. Range Exp. Stn., 809 N.E. 6th Ave., Portland, OR 97232. SFA 25(2)

80-001796 Dorfman, D. SENEGAL RIVER, AFRICA: FISHES OR DAMS? *Underwater Nat.* 12(2):4-6. 1980. SFA 25(2)
[Monmouth Coll., Long Branch, NJ]

80-001797 Dumas, J. LES SAUMONS (*SALMO SALAR* L.) ADULTES DE LA NIVELLE (PYRENEES-ATLANTIQUES) EN 1977. DEBUT DE RESTAURATION AVEC DES SMOLTS D'ELEVAGE D'ORIGINE ECOSSAISE. [THE 1977 SALMON (*SALMO SALAR* L.) RUN IN THE RIVER NIVELLE (PYRÉNÉNEES-ATLANTIQUES). FIRST SUCCESSFUL ATTEMPTS AT REHABILITATION WITH STOCKING OF HATCHERY-REARED SMOLTS OF SCOTISH ORIGIN.] *Ann. Limnol.* 15(2):223-238. 1979. In French with English summ. SFA 25(2)
[I.N.R.A., B.P. 3, Sainte-Pé-sur-Nivelle, 64310 Ascain, France] A sample of adult salmon from the river Nivelle shows that the population is being restored and that the contribution of hatchery-reared salmon is very important (58 percent). Grilse make up the bulk of the sample (91 percent of wild fish and all those of hatchery origin). «Hatchery grilse» were obtained from ova imported from a remote river in Northern Scotland; capture rate in the river of hatchery salmon released as 2-years-old smolts is 12 times better than that of 1-year-old smolts (1.42 percent vs. 0.12 percent). Whether wild or hatchery-reared, grilse of the river Nivelle enjoy one of the best growth rates in the Atlantic basin (67.7 cm). Sex-ratios of 1.5 to 1.7/1 in favor of females are very high. Releases of hatchery-reared smolts of foreign origin have given a good start to the process of rehabilitation of the Nivelle salmon stock which had virtually disappeared.

RIVER AND STREAM MANAGEMENT AND RESEARCH

80-001798 Graham, K. PADDLEFISH: GOOD NEW AND BAD NEWS... *Mo. Conserv.* 41(3):20-22. Mar. 1980. SFA 25(2)
[Mo. Dep. Conserv., Columbia]

80-001799 Graham, P. J.; R. F. Penkal and L. Peterman. AQUATIC STUDIES OF THE YELLOWSTONE RIVER. *U.S. Dep. Interior Bur. Reclam.* REC-ERC-79-8. vi + 80p. July 1979. SFA 25(2)
[Appl. Sci. Br., Div. Res., Eng. Res. Cent., Denver, CO] This study is a continuation of earlier lower Yellowstone River studies to determine the effects of streamflow alterations on various fish populations. These studies are part of a large-scale effort by the Bureau to determine the availability of water from the Yellowstone River and its tributaries for use in developing coal resources in southeastern Montana. Since fish migration is related to spawning, feeding, over-wintering, and other biological activities, any diversion structure which would impede movement may restrict the biological activities needed for continued survival or abundance of a species. Data required for this determination are: (1) effects of a dam upon movement; (2) changes, if any, in biological activities of the species both above and below the diversion; and (3) if movement is restricted, how the population is affected. Walleye and sauger were studied in this phase of the project because they are important game fish and have a wide range. Results of data collected by personnel of the Montana Department of Fish and Game on the life history and distribution of these two species are documented. The unique physical and hydraulic characteristics of the river necessitated adaptation of equipment and sampling techniques to accommodate these conditions. The problems of electrofishing a large river like the Yellowstone are discussed and the electrofishing boat used is described in detail.

80-001800 Kubicek, P. F. EVALUATION OF THE EFFECTS OF DIFFERENT STREAMFLOW RELEASES ON TROUT HABITAT BELOW HYDROELECTRIC DIVERSION DAMS: TWO CASE STUDIES. *Cal-Neva Wildl.* 1979:55-68. 1979. SFA 25(2)
[Pac. Gas Elec. Co., San Ramon, CA] Studies designed to evaluate the effects of different streamflow releases on trout habitat were conducted in the North Fork Feather River between Rock Creek Diversion Dam and Powerhouse and in Hat Creek between Hat Creek No. 2 Diversion Dam and Powerhouse. Physical habitat characteristics (depth, velocity, and substrate) were measured under select streamflow releases along transects at representative stations in each stream. Relative values of three important trout habitat parameters (resting microhabitat, food producing habitat, and spawning habitat) were calculated for each measuring point under each streamflow release through the use of weighting factors assigned to the measured habitat characteristics. The relationships between streamflow release and available resting microhabitat, food producing habitat, and spawning habitat for trout were derived and expressed quantitatively for each transect, station, and stream section. The resulting relationships, which showed considerable variation between stations and between habitat parameters, are discussed in relation to the Federal Energy Regulatory Commission licensing process for hydroelectric power projects.

80-001801 Lamb, B. L. and D. A. Sweetman, eds. GUIDELINES FOR PREPARING EXPERT TESTIMONY IN WATER MANAGEMENT DECISIONS RELATED TO INSTREAM FLOW ISSUES. *U.S. Fish Wildl. Serv.* FWS/OBS-79/37. iii + 32p. Sept. 1979. SFA 25(2)
[U.S. FWS, 2625 Redwing Rd., Fort Collins, CO 80526]

RIVER AND STREAM MANAGEMENT AND RESEARCH

80-001802 Nelva, A.; H. Persat and D. Chessel. UNE NOUVELLE MÉTHODE D'ÉTUDE DES PEUPLEMENTS ICHTYOLOGIQUES DANS LES GRANDS COURS D'EAU PAR ÉCHANTILLONNAGE PONCTUEL D'ABONDANCE. [A NEW METHOD FOR INVESTIGATING FISH POPULATIONS IN LARGE STREAMS BY MULTIPLE POINT ABUNDANCE SAMPLING.] *C.R. Hebd. Seances Acad. Sci. Ser. D Sci. Nat.* 289(16):1295-1298. Dec. 1979. SFA 25(2)

[Dep. Biol. Anim., Univ. Claude-Bernard, Lyon I, 43, boulevard du 11-novembre-1918, 69622 Villeurbanne Cedex, France] The usual methods of fishing cannot be applied to the study of the fish populations in large streams because of the size of these ecosystems. Our new method consists in collecting by electrofishing a great number of small-sized samples which are evenly distributed over the area investigated. The relative abundance of the species, the specific structure of the population and the relations between the species and their biotope can thus be determined.

80-001803 Robinson, J. W. THE MISSOURI RIVER FISHERY ... *Mo. Conserv.* 41(1):16-18. Jan. 1980. SFA 25(2)

[1110 College Ave., Fish & Game, Columbia, MO 65201]

80-001804 Sherwood, T.; D. Febinger and J. T. Windell. A HABITAT MANAGEMENT PLAN FOR THE ST. VRAIN WATERSHED BASED ON STREAM ORDER ANALYSIS. *J. Colo.-Wyo. Acad. Sci.* 12(1):13-14. Apr. 1980. Abstract only. SFA 25(2)

[Dep. Biol., Univ. Colo., Boulder]

80-001805 Wassenberg, P. S.; S. Olive; J. L. Demott and C. B. Stalnaker. ELEMENTS IN NEGOTIATING STREAM FLOWS ASSOCIATED WITH FEDERAL PROJECTS. *U.S. Fish Wildl. Serv.* FWS/OBS-79/03. v + 41p. Aug. 1979. SFA 25(2)

[U.S. FWS, 2625 Redwing Rd., Fort Collins, CO 80526]

80-001806 Wishard, S. K. ROAK FISHING AND ITS PROBABLE EFFECTS ON THE CAPTURE FISHERY OF RIVER YAMUNA IN AGRA DISTRICT. *Indian J. Fish.* 23(1/2):213-231. 1976. SFA 25(2)

[Cent. Inland Fish. Res. Substn., Allahabad, India] The total annual yield of the economically important fishes of Yamuna in Agra is estimated from the catch statistics collected from 1960 to 1968. Monthly and annual fluctuations in catches, changes in fishing mortality, year-class strength, and mean lengths are presented and discussed in relation to the fishing methods, especially that of erecting barriers across the river, locally called 'Roak'. The catch by this method alone, constituting 54-88% of the total annual catch, is responsible for the declining trends in the major carp fishery of the area. Management measures that may be adopted to offer protection to the migrating potential spawners of major carps are discussed.

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH

80-001807 Fong, S. DYNAMICS OF BASS-BLUEGILL POPULATIONS IN FARM PONDS. *Ph.D. dissertation, Auburn Univ.* 144p. 1979. From Diss. Abstr. Int. B Sci. Eng. 40(6):2453. Dec. 1979. SFA 25(2)

The effects of stocking with fingerling fishes on the dynamics of bass, *Micropterus salmoides* (Lacepede) and bluegill, *Lepomis macrochirus* (Rafinesque) fish populations in farm ponds was investigated both experimentally and by analysis of historical data. Two computer simulation models were constructed utilizing the statistical analysis of these data. The first model deals mainly with effects of stocking. A stocking rate of 400 bass per hectare gave a higher yield of bass than the 250/ha which was suggested by Swingle. The second model studied the fluctuation of the population for an indefinite period of time. Simulation of this model shows

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80-001807 CONTINUED that the bass stocking rate affects the yield of bass for many years but the bluegill population will be free from stocking effects three years after stocking. Given constant rates of exploitation, the bluegill population tends to stabilize while the bass population decreases through the years with the speed of descent dependent on the rate of exploitation of each of the species. The stochastic process of the bass-bluegill population was studied. Transition probability matrices under specific values of exploitation were simulated from the model. Information was proposed for improving the management of fish populations in farm ponds by use of Markov chain theory.

80-001808 McCaig, Robert S. EFFECT OF SEA-RUN ALEWIVES ON RAINBOW TROUT AND BROWN TROUT IN RECLAIMED PONDS. *Prog. Fish-Cult.* 42(1):59-63. Jan. 1980. SFA 25(2)
[Mass. Div. Fish. Wildl., Westboro 01581]

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH

80-001809 Heitman, J. F. A NEW APPROACH TO RESERVOIR FISHERIES MANAGEMENT. *Fisheries (Bull. Am. Fish. Soc.)* 5(1):18. Jan.-Feb. 1980. SFA 25(2)
[Rt. 4, Box 168, Eufaula, OK 74432]

80-001810 Heitman, J. F. and M. J. Van Den Avyle. SPECIES COMPOSITION, CATCH RATES, AND IMPACT OF A COMMERCIAL FISHERY ON STRIPED BASS IN WATTS BAR AND CHICKAMAUGA RESERVOIRS, TENNESSEE. *Proc. Annu. Conf. Southeast. Fish Wildl. Agencies* 32:576-587. 1978[1979]. SFA 25(2)
[Lake Eufaula Fish. Manage. Prog., Rt. 4, Box 1238, Eufaula, OK 74432] Between March and October 1977, methods of local commercial fishermen were simulated to evaluate species composition, catch rates, and potential impact of the commercial fishery on striped bass (*Morone saxatilis*) in 2 Tennessee River mainstream impoundments. Estimated total commercial harvest rates during the sampling period were 26.6 kg/ha and 23.1 kg/ha in Watts Bar and Chickamauga Reservoirs. Because commercial fishing was concentrated in tailwater regions of both reservoirs, experimental catch rates and high estimated commercial harvest rates were probably not representative throughout each reservoir. Low catch rates of striped bass and other game fishes suggested that commercial netting had no negative influence on these species. It does appear, however, that the commercial fishery may be influencing rough fish species composition. Standing crops of buffalofish (*Ictiobus* spp.) have declined in recent years while carp (*Cyprinus carpio*) biomass has increased.

80-001811 Sreenivasan, A. FISH PRODUCTION AND FISH POPULATION CHANGES IN SOME SOUTH INDIAN RESERVOIRS. *Indian J. Fish.* 23(1/2):134-152. 1976. SFA 25(2)
[Hydrobiol. Res. Stn., Madras 10, India]

ESTUARY MANAGEMENT AND RESEARCH

80-001812 Balling, S. S.; T. Stoehr and V. H. Resh. THE EFFECTS OF MOSQUITO CONTROL RECIRCULATION DITCHES ON THE FISH COMMUNITY OF A SAN FRANCISCO BAY SALT MARSH. *Calif. Fish Game* 66(1):25-34. 1980. SFA 25(2)
[Div. Entomol. Parasitol., Univ. Calif., Berkeley 94720] Effects of mosquito control recirculation ditches on species composition, density, and size and age structure of pickleweed (*Salicornia virginica*) salt marsh

ESTUARY MANAGEMENT AND RESEARCH

80-001812 CONTINUED fish community were analyzed in Albrae Slough marsh near Fremont, Alameda Co., California. Collections from January through August 1978 revealed that 10 species occupy ditched areas but only 5 species unditched areas. In an August 1978 inventory, fish density was three times greater in ditched (11.0 fish/m^2) than unditched (3.7 fish/m^2) areas. Size and age structure of the dominant species, *Gambusia affinis*, indicated that the ditched area populations have a greater proportion of immatures than found in unditched areas. The high proportion of immatures in the ditched area and in a recolonizing population examined 4 weeks after inventory indicates differential immigration by immatures. Ditching may increase diversity and density through improved habitat accessibility for fish from other areas and a ditch design which allows water retention at low tide, providing refuge for fish and their food.

MARINE MANAGEMENT AND RESEARCH

80-001813 Rørvik, C. J. THE NORWEGIAN INDUSTRIAL TRAWL FISHERY IN THE NORTH SEA. *Fiskeridir. Skr. Ser. Havunders.* 17(1):19-27. 1979. SFA 25(2)
[Inst. Mar. Res., Dir. Fish., Bergen, Norway] Linnear programming is used to demonstrate a way to maximise the total catch in a mixed fishery. Constraints are set by quotas, as well as requirements that the total catch should not be too unevenly distributed between areas and throughout the season. A practical application of this technique in fisheries management depends on a satisfactory prediction of the ratio of the quota-regulated species in the total catch before the season starts.

80-001814 Bakkala, R.; W. Hirschberger and K. King. THE GROUNDFISH RESOURCES OF THE EASTERN BERING SEA AND ALEUTIAN ISLANDS REGIONS. *Mar. Fish. Rev.* 41(11):1-24. Nov. 1979. SFA 25(2)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

80-001815 Jerpi, D. A. BOSTON FISH PIER LANDINGS, 1978: A REVIEW. *Mar. Fish. Rev.* 41(10):29-34. Oct. 1979. SFA 25(2)
[NMFS, 10 Commonwealth Pier, Boston, MA 02210]

80-001816 Lopez, A. M.; D. B. McClellan; A. R. Bertolino and M. D. Lange. THE JAPANESE LONGLINE FISHERY IN THE GULF OF MEXICO, 1978. *Mar. Fish. Rev.* 41(10):23-28. Oct. 1979. SFA 25(2)
[NMFS, 75 Virginia Beach Dr., Miami, FL 33149]

80-001817 Okamoto, M.; T. Kuroki and T. Murai. [FUNDAMENTAL STUDIES ON THE ECOLOGY OF FISHES NEAR ARTIFICIAL REEFS--I. PREPARATORY OBSERVATION OF FISH AMOUNT]. *Bull. Jpn. Soc. Sci. Fish.* 45(9):1085-1090. Sept. 1979. In Japanese with English summ. SFA 25(2)
[Jpn. Mar. Sci. Technol. Cent., Natsushima, Yokosuka, 237 Japan]

MISC. TECHNIQUES AND EQUIPMENT

80-001818 Foote, K. G. AVERAGING OF FISH TARGET STRENGTH FUNCTIONS. *J. Acoust. Soc. Am.* 67(2):504-515. Feb. 1980. SFA 25(2)
[Dep. Appl. Math., Univ. Bergen, 5014 Bergen, Norway] A general model for

MISC. TECHNIQUES AND EQUIPMENT

80-001818 CONTINUED averaging the acoustic target strength functions of fish is stated in calculable form. It accounts for the influences of the distribution of generally coupled spatial and orientation states of fish, geometric perspective, and beam patterns on observations of target strength. The model is developed and applied to observation of fish by directional, downward-looking sonars. A particular example is considered in which the sonar is represented by an ideal circular piston, the spatial distribution of fish is homogeneous, and the orientation distribution is spatially homogeneous and characterized by a uniformily distributed azimuthal variable and an independent, essentially normally distributed tilt angle variable. Averaged and averaged-squared backscattering cross sections are computed from high quality gadoid target strength functions measured at two ultrasonic frequencies. Results for a sonar half-beamwidth of 2.5 deg for three different realizations of the tilt angle distribution are expressed in the logarithmic domain and regressed linearly on fish length. The significance of species, frequency, and orientation distribution differences among the regressions is noted. Estimates of the mean ratio of averaged-squared backscattering cross section and squared-averaged backscattering cross section are presented.

80-001819 Huang, K. and C. S. Clay. BACKSCATTERING CROSS SECTIONS OF LIVE FISH: PDF AND ASPECT. *J. Acoust. Soc. Am.* 67(3):795-802. Mar. 1980. SFA 25(2)
[Gulf Res. Dev. Co., H.T.S.C., 11111 South Wilcrest, Houston, TX 77099]

80-001820 Lesh, E. W. A HEAD-OFF METHOD OF MEASURING CHINOOK AND COHO SALMON. *Calif. Fish Game* 66(1):59-62. Jan. 1980. SFA 25(2)
[Calif. Dep. Fish Game, 619 Second St., Eureka 95501]

80-001821 Sameoto, D. D. QUANTITATIVE MEASUREMENTS OF EUPHAUSIIDS USING A 120-kHz SOUNDER AND THEIR IN SITU ORIENTATION. *Can. J. Fish. Aquatic Sci.* 37(4):693-702. Apr. 1980. SFA 25(2)
[Bedford Inst. Oceanogr., Dartmouth, NS B2Y 4A2, Canada]

REVIEWS, BIBLIOGRAPHIES, ETC.

80-001822 Nicholson, H. F. BIBLIOGRAPHY ON THE LIMNOLOGY AND FISHERIES OF CANADIAN FRESHWATERS. NO. 6. *Can. Dep. Fish. Oceans Tech. Rep.* No. 911. v + 105p. Jan. 1980. In English with French summ. SFA 25(2)
[Can. Cent. Inland Waters, 867 Lakeshore Rd., Burlington, ON L7R 4A6 Canada] This bibliography is the sixth of a continuing series and contains a further 500 references and the Canadian freshwater features to which they refer.

80-001823 Spivey, R. B. (Compiler). BIBLIOGRAPHY OF TECHNICAL REPORTS 1979. *Woods Hole Oceanogr. Inst. Tech. Rep.* WHOI-80-14. 12p. 1979. SFA 25(2)
[Woods Hole Oceanogr. Inst., Woods Hole, MA 02543]

WATER USE AND CONSERVATION

80-001824 Koch, D. L. IMPACTS AND OPPORTUNITIES FOR AQUATIC BIOTA ASSOCIATED WITH ENERGY DEVELOPMENT IN NEVADA. *Cal-Neva Wildl.* 1979:74-77. 1979. SFA 25(2)

WATER USE AND CONSERVATION

80-001824 CONTINUED
[Desert Res. Inst., P.O. Box 60220, Reno, NV 89506] The impacts and opportunities for aquatic biota associated with energy developments in Nevada have been limited to this point in time but as environmental concerns of neighboring states such as California increase as well as more land areas for energy development become limited, Nevada will receive more pressure for energy developments. Projected electrical energy sales in the State of Nevada are from 7,623,731 MWH in 1975 to 18,518,390 MWH in the year 2000. If proper planning goes into energy developments in Nevada there are possible opportunities for aquatic biota such as: 1. utilization of waste heat sources to produce aquatic food organisms; 2. development and maintenance of aquaculture systems; and 3. creation of additional waterfowl habitats in arid climates.

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Varma, A. K.
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Vasilyeva, E. D.
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Verigina, I. A.
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Vigg, S.
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Viola, S.
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Vishnudatta, M. N.
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Vislie, T.
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Vladimirov, M. Z.
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Vogelman, J. H.
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Volohonsky, H.
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Volpe, N. O.
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von Lukowicz, M.
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Vrochinskiy, K. K.
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Wagner, D. S.
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Wagner, H. H.
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Waite, A. J.
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Walker, R.
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Walton, J. M.
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Ward, J. V.
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Wardle, C. S.
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Warner, R.
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Washington, B. B.
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Wassenberg, P. S.
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Watson, C. E.
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Watson, J.
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Weatherley, A. H.
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Webb, P. W.
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Weber, L. J.
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Weber, S.
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Webster, J. R.
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Wefring, D. R.
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Weihs, D.
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Weithman, A. S.
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Wellings, S. R.
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Wendelaar Bonga, S. E.
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Whitear, M.
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Whitehead, C.
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Whitledge, T. E.
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Wick, E. J.
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Wilde, D. W.
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Wilson, D. E.
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Winstead, J. T.
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Winter, G. W.
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Wishard, S. K.
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Wisner, R. L.
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Yamamori, K.
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Yeh, Y.
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Yone, Y.
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Alabama: Pickwick Reservoir
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Alabama: West Point Reservoir
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80-001440
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80-001714
Alaska: Olsen Creek
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80-001388
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Antarctica
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Arabian Sea
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Arizona: Colorado River
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Atlantic Ocean, North
80-000918
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80-001602
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80-001745
80-001813
Atlantic Ocean, North: Scotian Shelf
80-001400
Atlantic Ocean, North: South Atlantic Bight
80-001429
Atlantic Ocean, Southwestern
80-001453
Australia
80-001359
80-001500
80-001575
80-001576
80-001577
80-001622
Australia: Port Philip Bay
80-001568
Baltic Sea
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80-001601
Barents Sea
80-001220
Bering Sea
80-001814
Black Sea
80-001151
California
80-000785
80-000794
80-001266
80-001404
80-001477
80-001560
80-001613
80-001713
80-001748
80-001800
80-001812
California: Clear Lake
80-001612
California: Humboldt Cty.: Freshwater Lagoon
80-001760
California: Humboldt Cty.: Redwood Creek
80-001739
California: Jackson Meadows Reservoir
80-001762
California: Lake Perris
80-001759
California: Merle Collins Reservoir
80-001249
California: North Fork Feather River
80-001753
California: Pacific Current
80-001389
California: Sacramento River
80-001619
Canada: British Columbia
80-001611
80-001715
80-001732
Canada: British Columbia: Centennial Creek
80-001736
Canada: British Columbia: Kootenay Trout Hatchery
80-001574
Canada: British Columbia: Nanaimo River Estuary
80-001222
Canada: British Columbia: Tsolum River
80-000793
Canada: Experimental Lakes Area
80-000852
Canada: Manitoba: Assiniboine River
80-001473

Canada: Manitoba: Indian Lake
80-001480
Canada: New Brunswick: Saint John River Estuary
80-001211
Canada: Nova Scotia: Scotian Shelf
80-001400
Canada: Quebec
80-001355
80-001526
80-001592
Canada: Quebec: Gulf of St. Lawrence
80-000854
Chile
80-001556
80-001557
Colorado
80-000850
80-001630
Colorado River Basin
80-001366
Colorado: Larimer Cty.: Parvin Lake
80-001789
Colorado: St. Vrain River
80-001804
Colorado: White River
80-001371
Colorado: Yampa River
80-001371
Columbia River
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Delaware
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England: English Channel
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England: River Severn
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England: Slapton Ley
80-001436
England: South Lancashire
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England: Windemere
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Finland: Gulf of Finland
80-001290
80-001295
Florida
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80-001641
Florida: Apalachee Bay
80-001337
Florida: Florida Keys
80-001368
Florida: Hillsborough Bay
80-001418
Florida: Hillsborough River
80-001317
Florida: Lake Conway
80-001219
Florida: Lido Key
80-001730
Florida: Okaloosa Cty.
80-001387
Florida: Orange Cty.
80-001648
Florida: Tampa Bay
80-001298
80-001374
80-001420
Florida: Tampa Bay: McKay Bay
80-001589
France: Nivelle River
80-001797
French Polynesia
80-001378
Georgia
80-001743
Georgia: Bibb Cty.: Lake Tobesofkee
80-001237
Georgia: Savannah River Estuary
80-001725
Georgia: West Point Reservoir
80-001363
Great Lakes
80-001213
80-001788
Gulf of California
80-001477
Gulf of Mexico
80-000921
80-001284
80-001387
80-001513
80-001600
80-001726
80-001816
Gulf of Oman
80-001334
Hawaii
80-001301
Idaho: Palouse River
80-001401
Idaho: Panther Creek
80-001638
India
80-000788
80-000809
80-000849
80-001352
80-001357
80-001410
80-001421
80-001585
80-001811

India: Chilka Lake
80-001230
80-001245
India: Gulf of Mannar
80-000894
India: Moplah Bay
80-001466
India: Yamuna River
80-001806
Indian Ocean
80-000894
80-001246
80-001267
80-001273
80-001352
80-001357
80-001421
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80-001628
80-001639
Indonesia
80-001411
Indonesia: Rawa Pening
80-001787
Iowa
80-001422
Iowa: Des Moines River
80-001625
Iowa: Maquoketa River
80-001414
Iowa: Story Cty.: Ames
80-001550
Israel
80-000791
80-000807
80-000811
80-001564
Israel: Lake Kinneret
80-000853
Japan
80-001143
80-001172
80-001202
80-001217
80-001294
80-001296
80-001584
Japan: Lake Notoro
80-000889
Japan: Tokyo Bay
80-001633
Japan: Yahagi River
80-000892
Kansas
80-001351
80-001647
Kansas: Doniphan Cty.: Wolf River
80-001373
Kentucky
80-000808
Kentucky: Barkley Lake
80-001302
Kentucky: Herrington Lake
80-001758
Kentucky: Kentucky Lake
80-001302
Kentucky: Ohio River
80-001257
80-001303
Kentucky: Rough River Reservoir
80-001223
Lake Erie
80-000857
80-001181
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Lake Michigan
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80-001675
Lake Superior
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Louisiana
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80-001365
80-001382
80-001383
80-001415
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Louisiana: Caminada Bay
80-001408
Louisiana: Chenier Plain Coastal Area
80-001379
80-001380
80-001381
Maryland
80-001631
Massachusetts
80-001386
80-001744
80-001808
Massachusetts: Beverly-Salem Harbor
80-001394
Massachusetts: Boston Harbor
80-001815
Massachusetts: Connecticut River
80-001286
80-001307
Massachusetts: Pleasant Bay
80-001376
Mediterranean Sea
80-001073
Mexico: Sonora
80-001406
Mexico: Yucatan
80-001431
Michigan
80-001184
80-001632
80-001636
80-001791
80-001792

Michigan: Lawrence Lake
80-001340
Michigan: Manistee Lake
80-001770
Michigan: Ogemaw Cty.: Jewett Lake
80-001764
Michigan: Spring Brook
80-001214
Minnesota
80-001731
Minnesota: Scott Cty.: Carls Lake
80-001786
Mississippi
80-000832
Mississippi: Grenada Reservoir
80-000861
Missouri
80-001798
Missouri River
80-001803
Missouri: Lake Taneycomo
80-001752
Missouri: Missouri River
80-001803
Missouri: Thomas Hill Reservoir
80-001742
Montana
80-001391
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Montana: Yellowstone River
80-001799
Nebraska
80-001444
80-001749
Nevada
80-001824
Nevada: Pyramid Lake
80-001297
New Jersey
80-001741
New Jersey: Newark Bay
80-001423
New Mexico
80-001282
New Mexico: San Juan River
80-001405
New York
80-001369
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New York: Cazenovia Lake
80-001168
New York: Hudson River Estuary
80-001606
New York: Lake George
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New York: New York Bay
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New York: Oneida Lake
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New Zealand
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80-000983
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New Zealand: Karikari Peninsula
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North Carolina: Belews Lake
80-001616
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North Carolina: Currituck Sound
80-000782
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North Carolina: Onslow Bay
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North Sea
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Northern Ireland
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Northern Ireland: Foyle
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Norway: Lake Tveitevatn
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Ohio: Chagrin River
80-001430
Oklahoma
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Oklahoma: Keystone Reservoir
80-001304
Oklahoma: Lake Eufala
80-001809
Oklahoma: Lake Texoma
80-001277
Oklahoma: South Canadian River
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Oregon
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Oregon: Antelope Reservoir
80-001637
Oregon: Coos Bay
80-001723
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Pacific Ocean: Australia
80-001622
Pacific Ocean: Chile
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Pennsylvania: Susquehanna River: Conowingo Pond
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Pennsylvania: Washington Cty.: Buffalo Ck.
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Scotland: Outer Hebrides
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South Africa: Lake Baugazi
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South Carolina: Keowee Reservoir
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South Carolina: South Atlantic Bight
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Tennessee
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Tennessee: Center Hill Reservoir
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Tennessee: Old Hickory Reservoir
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Texas: Chenier Plain Coastal Area
80-001379
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Texas: Devil's River
80-001375
Texas: Galveston Bay
80-001336
Texas: Lake Bastrop
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Texas: Lake E. V. Spence
80-001330
Texas: Lake Texoma
80-001277
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Turkey: Lake Acigöl
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USSR: Amur Estuary
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USSR: Argun River
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USSR: Kamchatka River
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USSR: Kuybyshev Reservoir
80-001234
USSR: Lake Khanka
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USSR: Mozhaysk Reservoir
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USSR: Sea of Azov
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USSR: Taganrog Gulf
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USSR: Upper Tuloma Reservoir
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Venezuela: Lake Valencia
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Virginia: James River
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Virginia: New River
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Virginia: South Fork Shenandoah
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Washington: Columbia River
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Washington: Palouse River
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Washington: Puget Sound
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Wyoming: Fontenelle Reservoir
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Acipenser brevirostrum
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Acipenser guldenstadti
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Acipenser ruthenus
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Acipenser transmontanus
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Alopias vulpinus
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Alosa pseudoharengus
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Malachite Green
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Salt
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Swimbladder
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